ECHNOLOGY DEPT.

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RUBBER WORLD

tents, page 503

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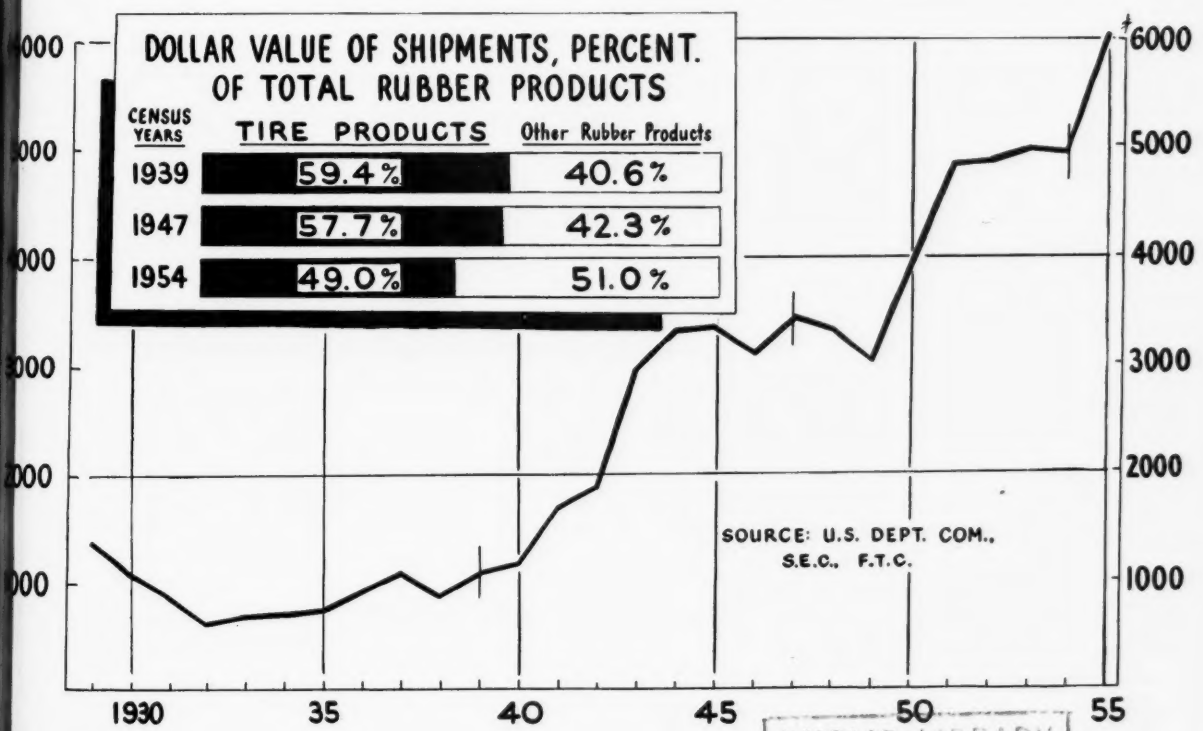

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UBLICATION

GROWTH TRENDS IN RUBBER INDUSTRY

By W. James Sears, page 513

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Cover photo: courtesy of The Rubber Manufacturers Association, Inc.

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Phillips 66 **PHILLIPS CHEMICAL COMPANY,** Rubber Chemicals Division, 318 Water St., Akron 8, Ohio. Export Sales: 80 Broadway, New York 5, N. Y. West Coast: Harwick Standard Chemical Company, Los Angeles, California.

News about

B.F.Goodrich Chemical *raw materials*

* reduced milling time

* Hycar meets aeronautical specs

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AMS 3211A . . . requiring good resistance to hot ethylene glycol-water mixtures, for packings and joint sealing compounds. A blend of Hycar 1042 and GR-S 1501 is entirely satisfactory.

AMS 3215F . . . requiring continuous or alternating exposure to both aromatic and non-aromatic fuels, for products such as gaskets, diaphragms, bushings, grommets, and sleeves. A Hycar 1042 compound meets the specification.

AMS 7260 . . . requiring good resistance to fuels, plus flexibility at temperatures down to 65° below zero. A Hycar 1043 compound meets the standards; applications include gland type packings and flexible couplings.

AMS 7270B . . . properties required include fuel resistance, flexibility at −65°F, aging in hot oil, cyclic fuel aging, and dry heat aging, for sealing ring application. A Hycar 1042 formulation is satisfactory.

AMS 7274C . . . requiring maintenance of properties under extreme variations in temperature and exposure to hot oils, for sealing ring application. A Hycar 1043 compound meets all minimum values.

AMS 3213F . . . requiring maximum resistance to aromatic and non-aromatic fuels when continuously or alternately exposed to both, for applications such as gaskets, bushings, grommets, and sleeves. A Hycar 1042 compound meets all values.

AMS 7271 . . . requiring service at temperatures to −65°F, with exposure to fuels, for sealing rings. Here a blend of Hycar 1042 and GR-S 1501 passes requirements.

For further information on Hycar nitrile rubber, write Dept. ES-1, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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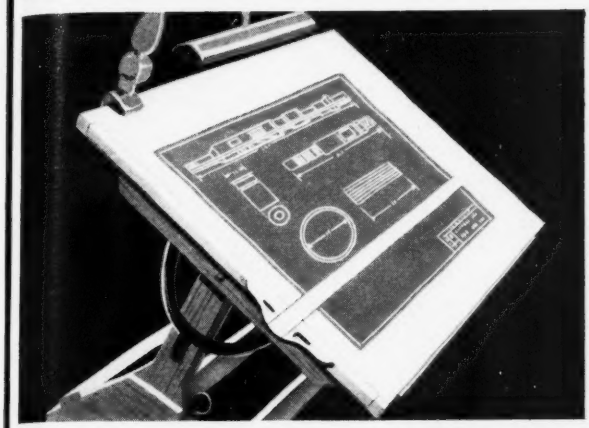

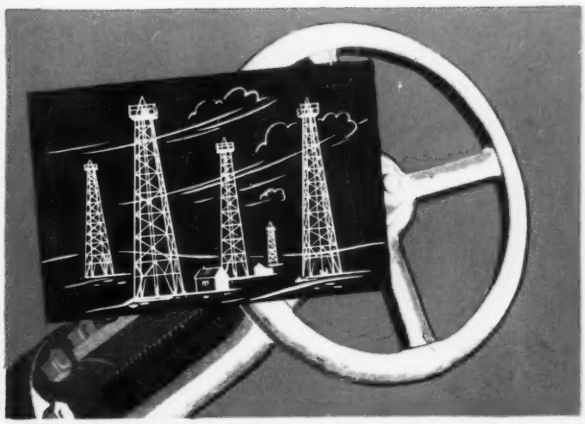

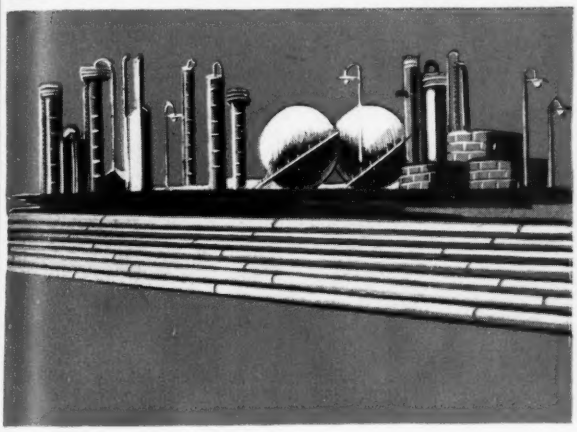

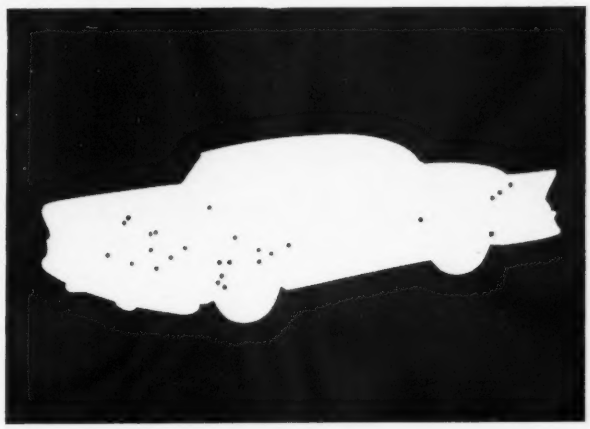

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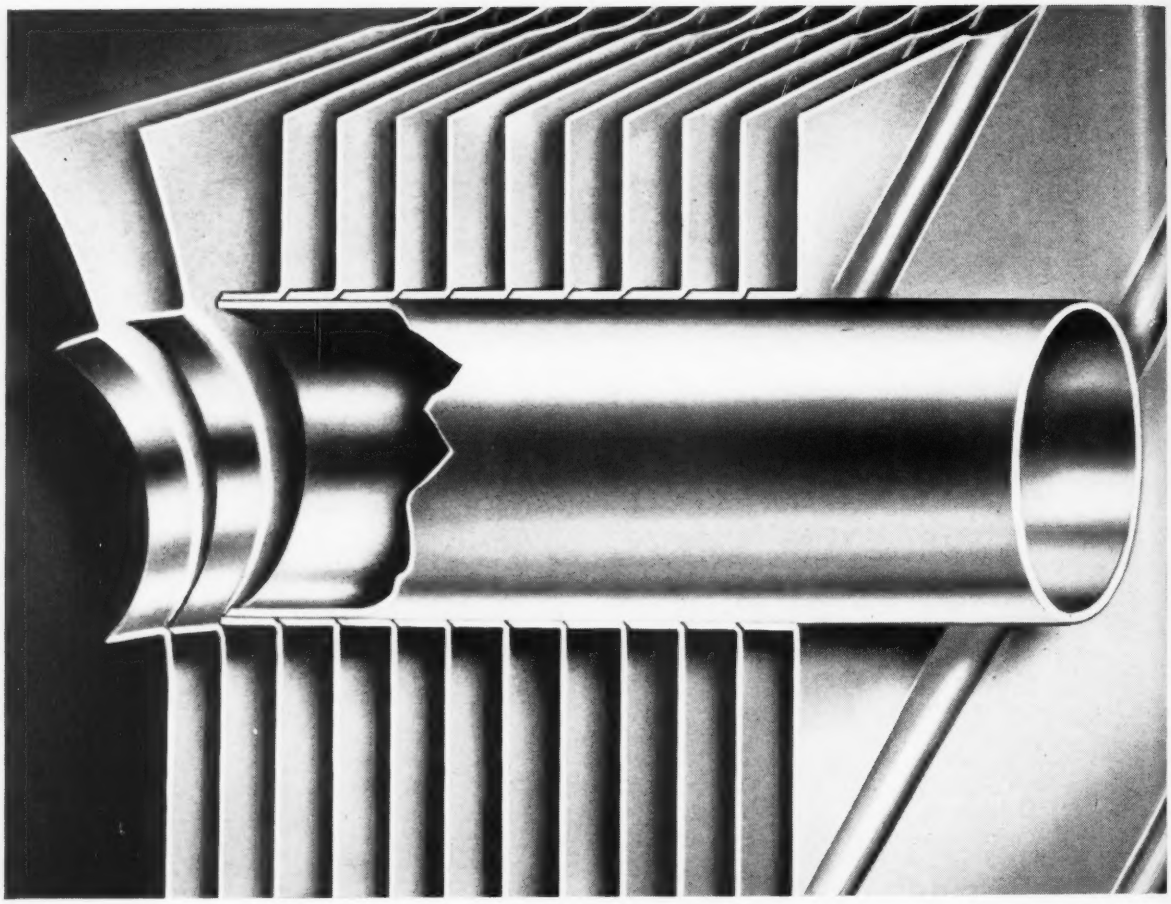

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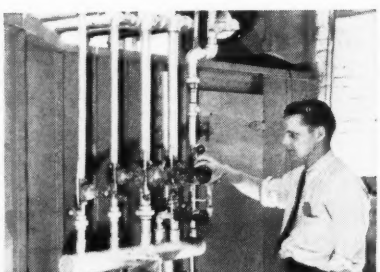

Laboratory test of Westinghouse heating coils helps assure long heating life at rated performance.

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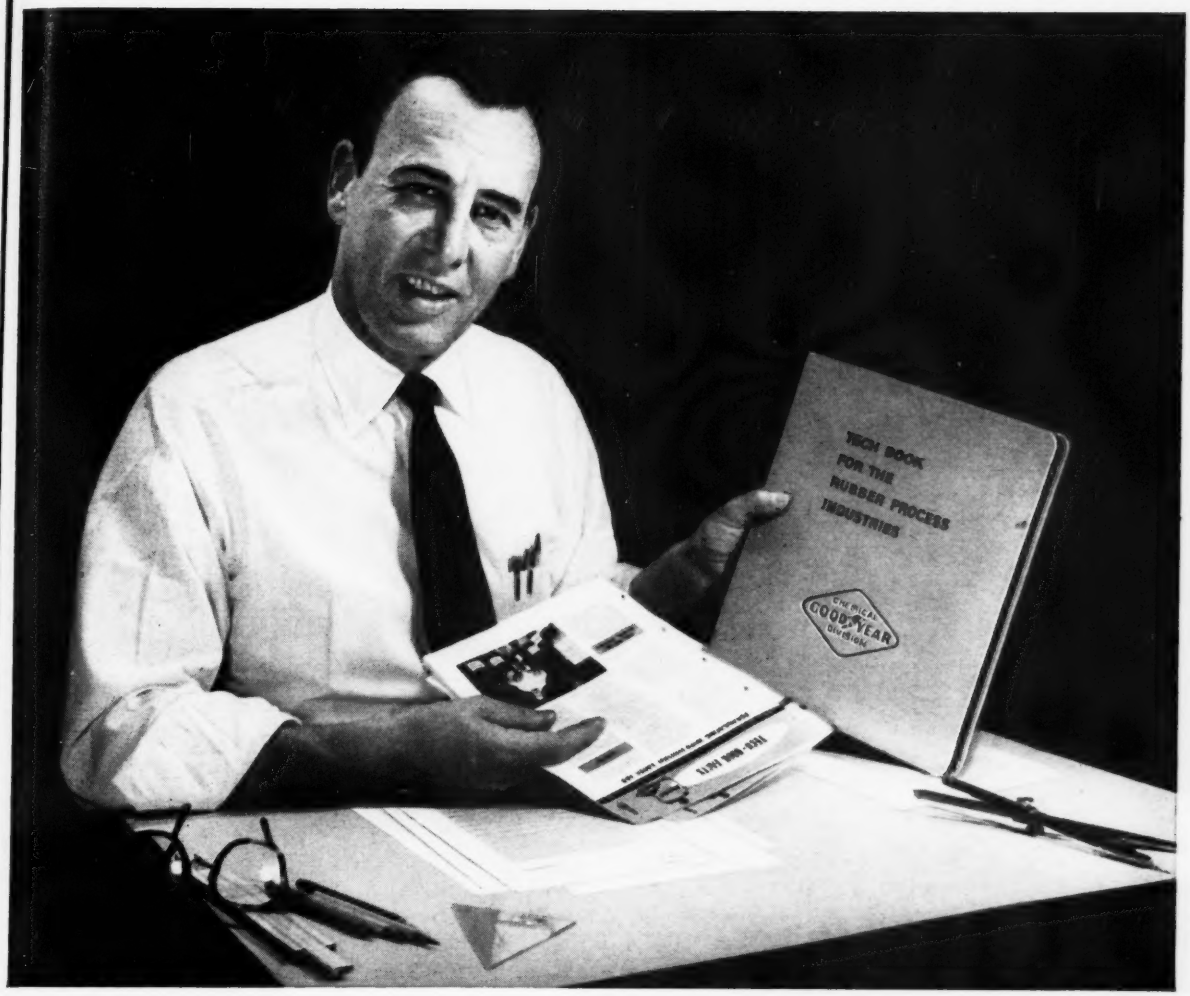

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In the Tech Book, you'll find answers to such questions as: What are the physical properties of PLIOFLEX 1006? Which of the PLIOFLEX rubbers are oil-extended? How does the new CHEMIGUM N-6B differ from its sister nitrile rubbers? How do you compound CHEMIGUM N-7 to meet Specifications AMS 7274C? And you'll also find similar information on PLIOLITE S-6B – the rubber reinforcing resin – and WING-STAY S – a nonstaining antioxidant.

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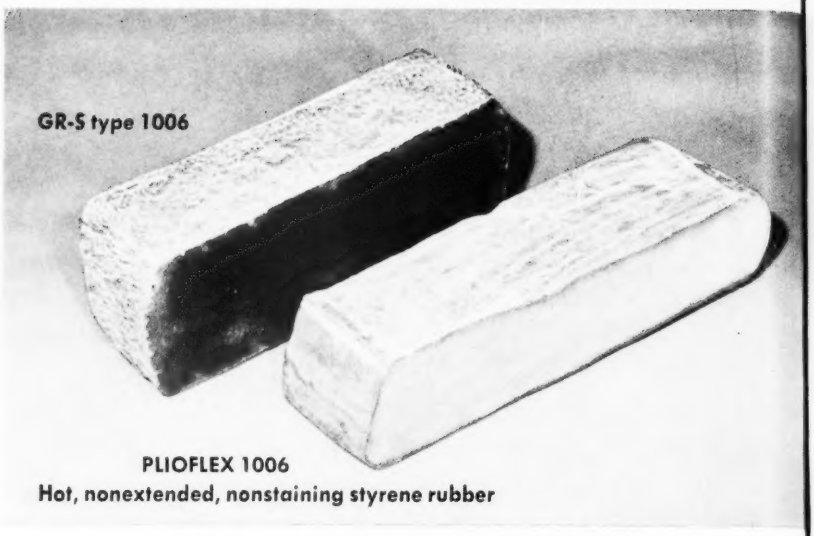
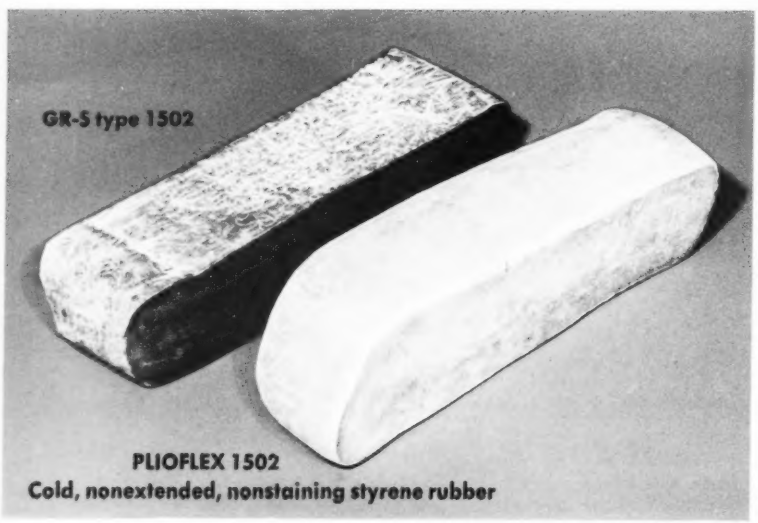
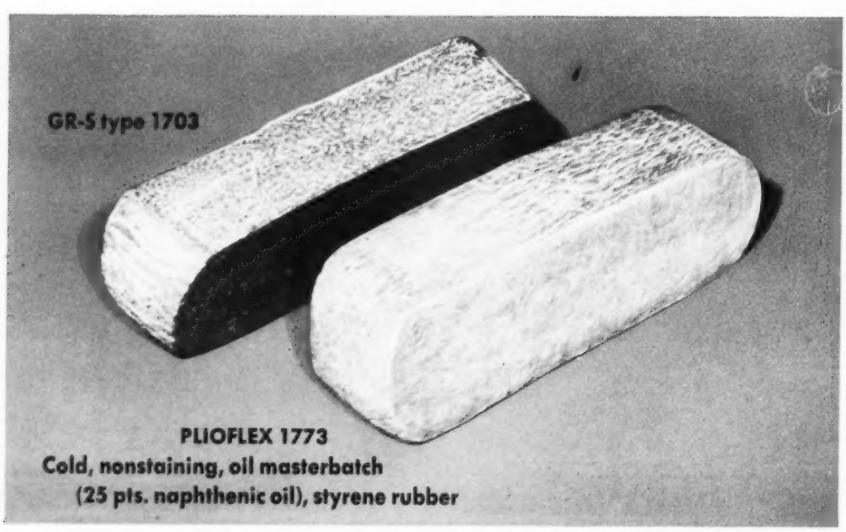


PLIOFLEX 1006
Hot, nonextended, nonstaining styrene rubber



PLIOFLEX 1502
Cold, nonextended, nonstaining styrene rubber

How many



PLIOFLEX 1773
Cold, nonstaining, oil masterbatch (25 pts. naphthenic oil), styrene rubber

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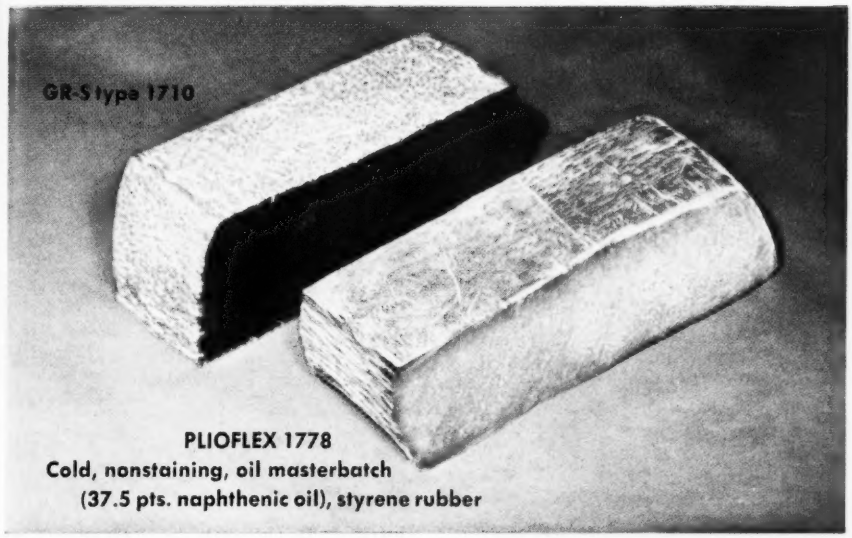
High Polymer Resins, Rubbers, Latices and



ny new products here for you?

Pictured on these pages are unretouched photographs of various styrene-butadiene rubbers, those formerly designated as GR-S in contrast with corresponding PLIOFLEX rubbers now produced by Goodyear. They quickly tell the story of improvements made in both raw materials and manufacturing techniques to bring you the best, most complete line of nonstaining, non-discoloring rubbers ever to be offered.

But these pictures should do more than tell of past accomplishments. What about the present and the future? What thoughts do they bring to your mind about improving present products with PLIOFLEX? How many totally new products do they start you thinking about?

Probably the most significant feature of the new PLIOFLEX line lies in its ability to meet fully the demands of color-conscious consumers and to do it over a wide range of physical properties and cost. This is particularly true since the new light color of PLIOFLEX, in both nonextended and oil-extended types, combines excellent physical properties and processing characteristics at minimum cost.

In other words, with PLIOFLEX you can now compete for markets demanding critical color specifications—markets never before open to synthetic rubber.

Learn more about the new, light color of PLIOFLEX, and discover how it can help you to new or improved products. Why not write, right now, for the full story, including the latest *Tech Book Bulletins*, to: Goodyear, Chemical Division, Akron 16, Ohio.

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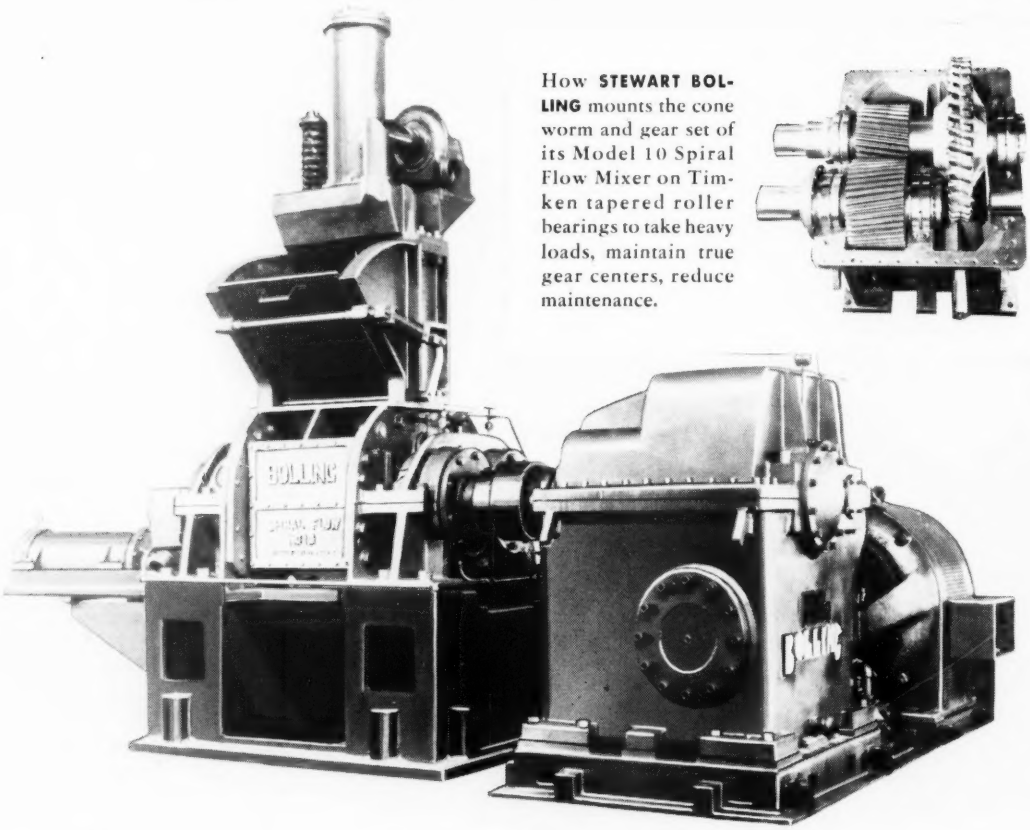
TIMKEN® bearings on Stewart Bolling Mixers permit high mixing speeds resulting in lower production costs

How **STEWART BOLLING** mounts the cone worm and gear set of its Model 10 Spiral Flow Mixer on Timken tapered roller bearings to take heavy loads, maintain true gear centers, reduce maintenance.



STEWART BOLLING AND COMPANY, Incorporated, mounts the mixer rotor shafts of its Model 10 Spiral Flow Mixer on Timken® tapered roller bearings to get: 1) maximum shaft rigidity, 2) greater accessibility, 3) lower maintenance costs, 4) top performance. Six Timken bearings also were specified for the cone worm, worm gear, and connecting gear shafts of this heavy-duty mixer drive.

The tapered design of Timken bearings enables them to take punishing radial and thrust loads in any combination, eliminating the need for special thrust devices. The mixer rotor shafts are held in rigid alignment. With shafts accurately aligned, true gear centers are maintained, the gears mesh smoothly, wear longer.

Timken bearings practically eliminate friction because they are geometrically designed to have true rolling motion, and are precision-manufactured to conform to their design. Full line contact between rollers and races gives Timken bearings extra load-carrying capacity. And rollers and races are case-carburized to give them hard, wear-resistant surfaces over tough, shock-resistant cores.

The Timken Company is the only bearing manufacturer in America that safeguards quality by making its own steel—and it is all electric furnace fine-alloy steel. Next time you build or buy a machine, make sure its bearings are the best. Look for the trademark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

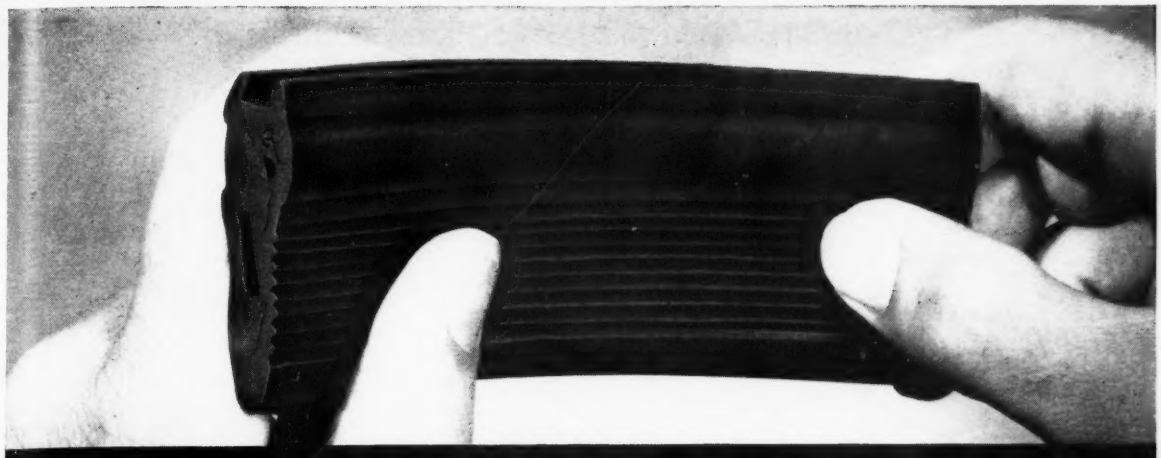
TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD



IT'S EASY TO TELL WHICH EXTRUSION HAS THE

SYNPOL 1009

FOR RUBBER PRODUCTS NEEDING THESE PROPERTIES

- Outstanding dimensional stability
- Clean, precise definition
- Faster extrusions
- Proven power-savings in mixing

Use Synpol 1009

With the addition of a small percentage of SYNPOL 1009 you reduce shrinkage to the minimum, save power in mixing and produce a faster extruding stock with outstanding dimensional stability.

The photo on top shows a butadiene-styrene copolymer extrusion that through blowing and swelling has a distorted profile, and surface imperfections. In the lower photo, by the addition of 10% SYNPOL 1009, irregularities have been eliminated. There is no jaggedness of the edges. The extrusion is smooth and well defined. These advantages can also be obtained by blending SYNPOL 1009 with natural rubber or neoprene compounds.

If you plan to produce a new product or improve your present line, write for processing data and compound formulations from your TEXUS technical sales representative.

Carload Pooled Shipments

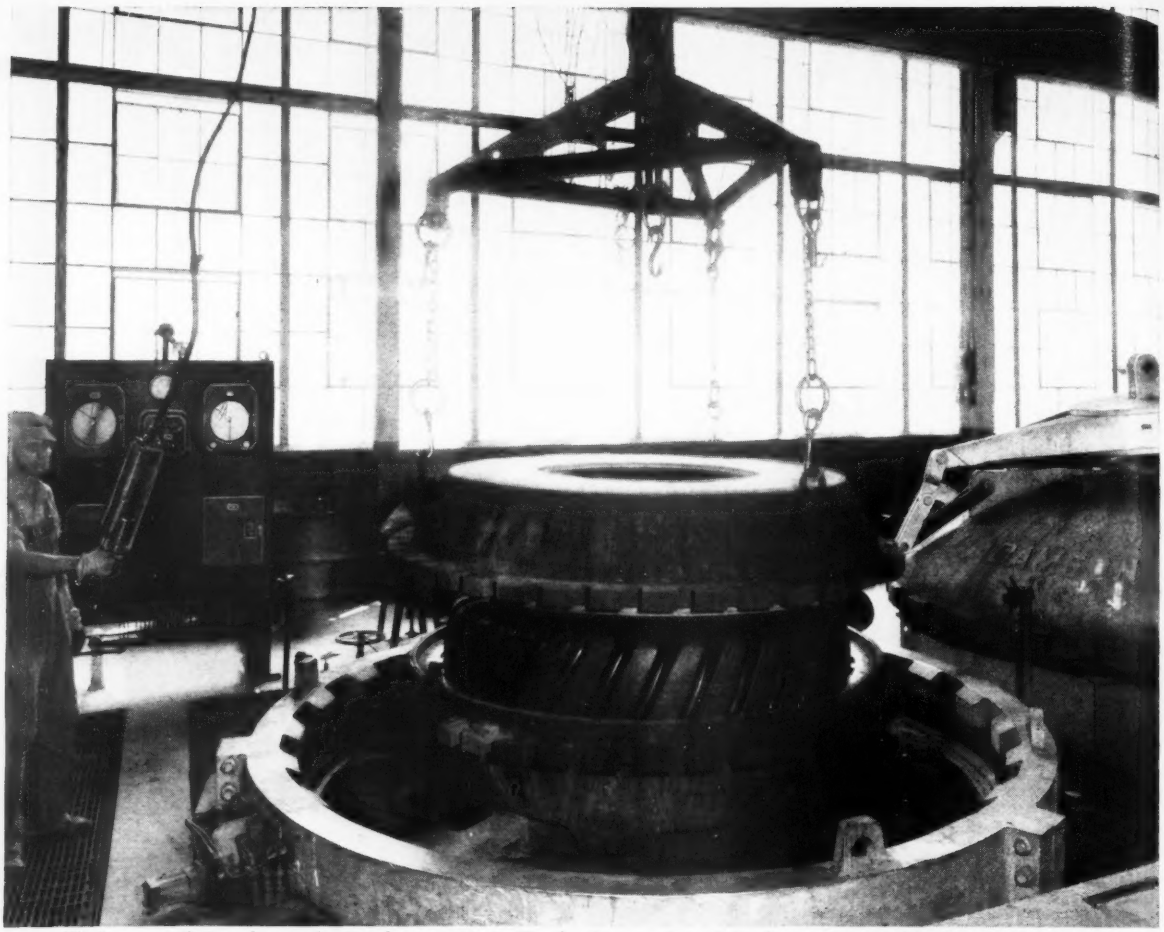
Take advantage of carload discounts by pooling all your requirements from SYNPOL grades and types—the broadest available line of butadiene-styrene rubbers which includes: 1000, 1001, 1002, 1006, 1007, 1009, 1012, 1013, 1061, 1500, 1502, 1551, 1703, 1707, 1708, 1711.

TEXUS

Sales Agent
Naugatuck Chemical
Naugatuck, Conn.

Plants
Texas-U. S. Chemical Co.
Port Neches, Texas

TEXAS-U. S. CHEMICAL COMPANY
260 Madison Ave., New York 16, N. Y.



Taylor-controlled pot-heaters for Earthmover tires at Topeka, Kansas, plant of Goodyear Tire & Rubber Co. of Kansas, Inc.

Goodyear's tougher with Taylor

GOODYEAR "Earthmovers" are tougher because of Taylor precision controls on their pot-heaters. That's important because these 1600-lb. tires must carry mammoth loads and travel at speeds unknown to old-fashioned earth-moving equipment.

Goodyear officials say: "Properly controlled cure of Earthmover tires has first preference in the design of equipment." This meant ±1 degree in temperature . . . this meant ±1% in time . . . this meant Taylor Control Systems for fully automatic timing and temperature.

A Taylor FULSCOPE* Temperature Controller regulates the temperature. The complete cure is precision-timed by two Taylor FLEX-O-TIMERS*—a sequence timer for a range from two to 192 minutes and a cure timer having a range from 18 to 1,440 minutes.

THIS FULLY AUTOMATIC TIMING MEANS:

1. Improved tire quality—the automatic cure cycles *are uniform.*

2. Improved plant efficiency—automatic cure timing permits *closer scheduling of heats,* reduces idle time of equipment and operators.

3. Reduced processing costs—there's *no need for a "steam-tender"* to time curing stages.

The man to suggest what Taylor Control Systems can mean in your plant is your Taylor Field Engineer. Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

the wise move is with

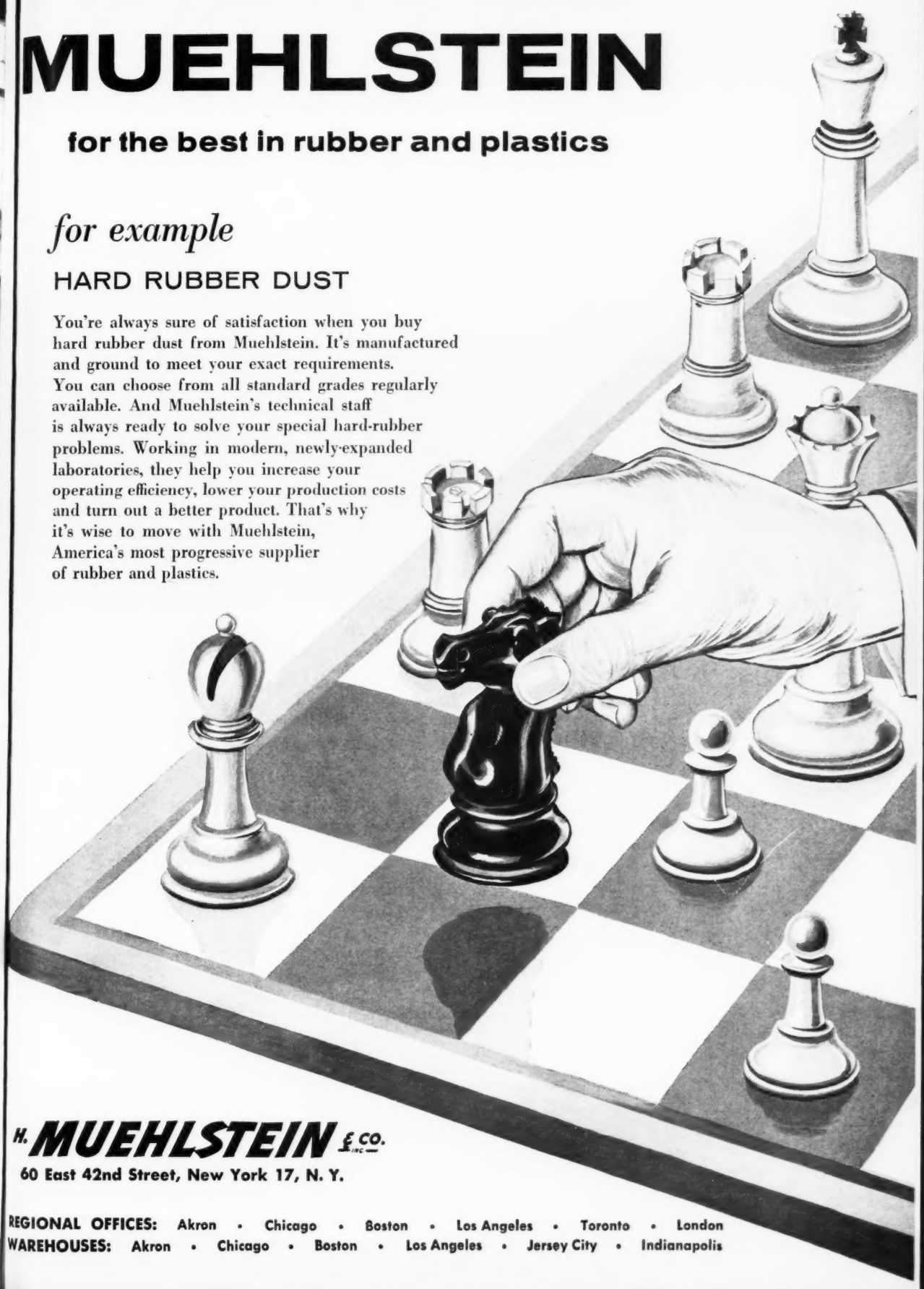
MUEHLSTEIN

for the best in rubber and plastics

for example

HARD RUBBER DUST

You're always sure of satisfaction when you buy hard rubber dust from Muehlstein. It's manufactured and ground to meet your exact requirements. You can choose from all standard grades regularly available. And Muehlstein's technical staff is always ready to solve your special hard-rubber problems. Working in modern, newly-expanded laboratories, they help you increase your operating efficiency, lower your production costs and turn out a better product. That's why it's wise to move with Muehlstein, America's most progressive supplier of rubber and plastics.

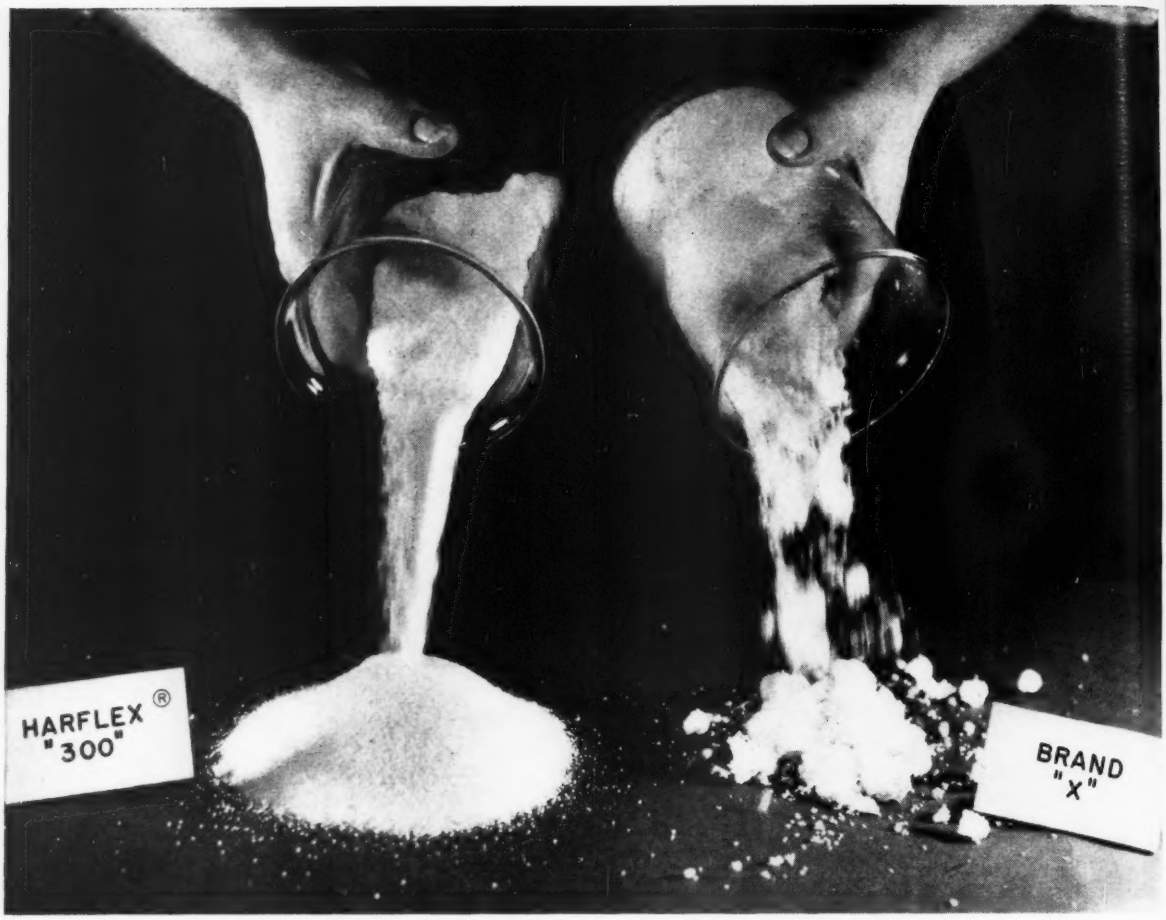


H. MUEHLSTEIN & CO. INC.

60 East 42nd Street, New York 17, N. Y.

REGIONAL OFFICES: Akron • Chicago • Boston • Los Angeles • Toronto • London

WAREHOUSES: Akron • Chicago • Boston • Los Angeles • Jersey City • Indianapolis



HARFLEX® 300

PERMITS A FREE FLOWING DRY BLEND

In a typical test, 64 parts of **HARFLEX®** 300, preheated to 212°F, were mixed with 100 parts of an easy-processing polyvinyl chloride resin at 212°F. After 30 minutes of thorough agitation, a dry, free flowing powder was obtained which could be put directly into an extruder. When a free flowing dry blend is used directly, as in extrusion operations, it is possible to eliminate or minimize extra operations such as Banbury mixing or roll milling.

HARFLEX® 300 is a permanent polymeric plasticizer, readily adaptable to dry blending. Write for our free technical bulletin that gives full information about **HARFLEX®** 300. Samples for your test or experimental work are also available at your request.

COLUMBIAN CARBON COMPANY, DISTRIBUTOR TO THE RUBBER INDUSTRY

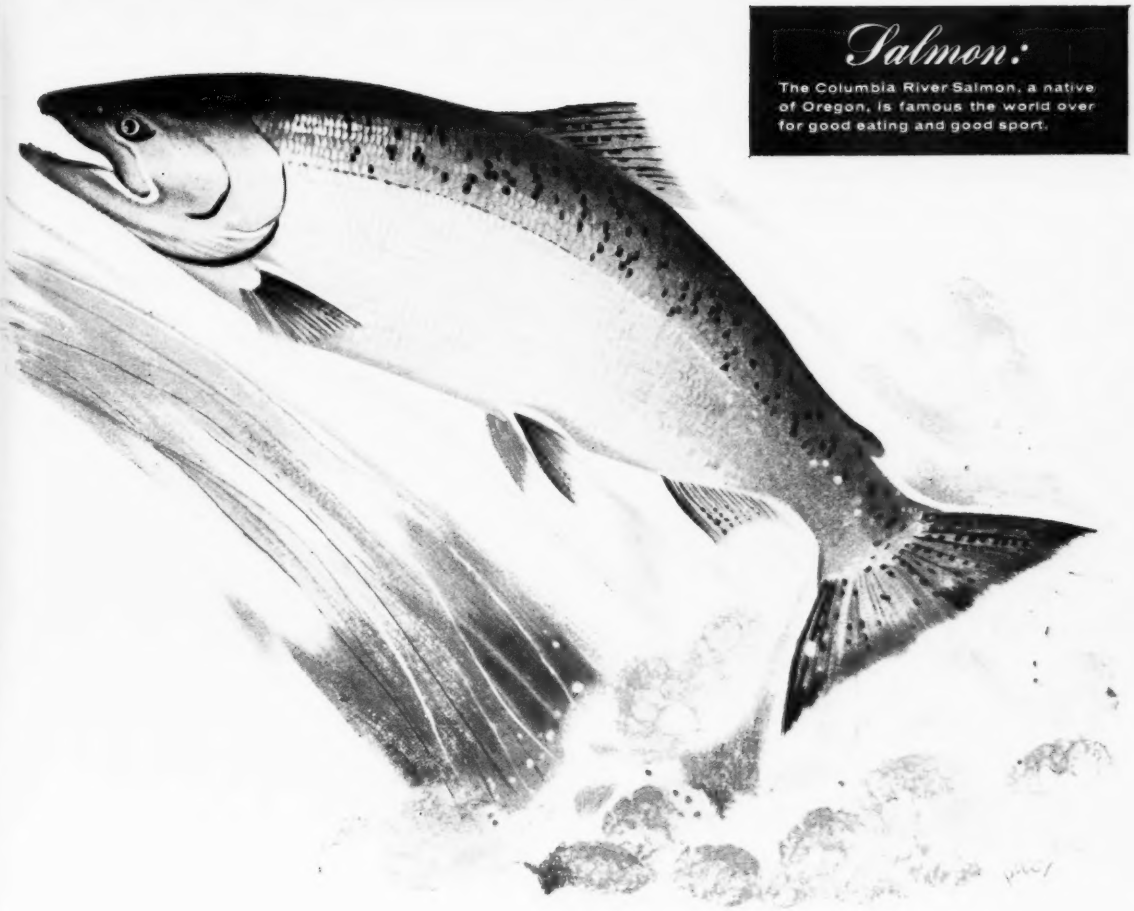
SEBACATES
PHTHALATES
ADIPATES

H-21-R

THE KEY TO
HARCHEM®
BETTER PLASTICS

HARCHEM DIVISION

WALLACE & TIERNAN, INC.
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY
IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO



Salmon:
The Columbia River Salmon, a native of Oregon, is famous the world over for good eating and good sport.

SYNTHETIC RUBBER

is a product of the West, too!

ADD SYNTHETIC RUBBER to the many bounties of the West! Shell Chemical's plant at Torrance, California, produces a full line of butadiene-styrene type synthetic rubber to fill the needs of large and small Western manufacturers.

Next time, try Shell synthetic rubber, available in a variety of solid types and liquid latices. It can do a better job for you.

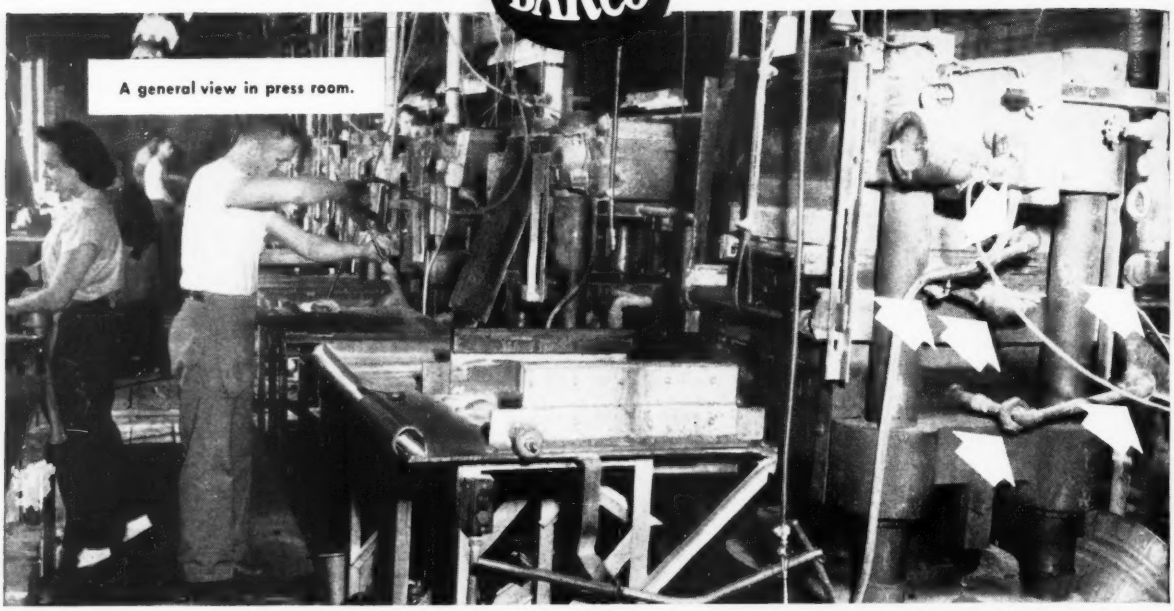
Convenient location and diversity of product make Torrance your logical source for synthetic rubber West of the Rockies. In addition, Shell's Technical Service Laboratory is ready to help you find practical solutions for troublesome technical problems.

Think of Torrance, California, whenever you need synthetic rubber. Our phone number in Los Angeles is FAculty 1-2340.

SHELL CHEMICAL CORPORATION
Synthetic Rubber Sales Division
P. O. Box 216, Torrance, California

SHELL

SWIVEL JOINTS **BARCO** REVOLVING JOINTS



A general view in press room.

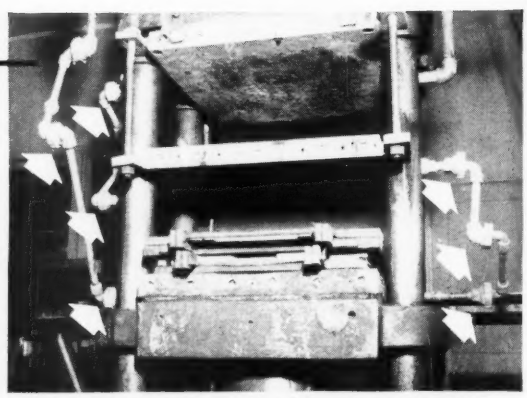
How Lavelle Rubber Mfg. Corp. Cuts Costs, Improves Machine Performance!

—with BARCO TYPE S SWIVEL JOINTS

"Barco Joints have saved us literally thousands of dollars in our three years' experience with them," says Robert Sullivan, Jr., Works Manager of Lavelle Rubber Mfg. Corp., Burlington, Wisc. This plant has 117 Barco "Self-Aligning" Type S Swivel Joints on piping connections to press platens where they work 16 hours per day handling 110 psi steam at 340°F. The only maintenance in three years has been three gaskets. Prior to that time, they averaged two hours a week replacing hose at a cost of $2.00 a foot, plus loss of production and cost of labor.

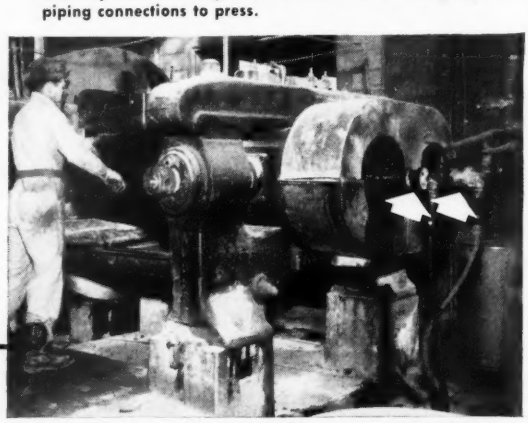
Lavelle Rubber Mfg. Corp. also uses Barco 1½" Type IBRA Revolving Joints on a 60" rubber mill running 24 hours a day. In 2½ years, they have given perfect service with no maintenance whatsoever.

FOR TROUBLE-FREE, LEAKPROOF SERVICE, INSTALL BARCO JOINTS IN YOUR PLANT TODAY!



Close-up view showing Barco Swivel Joints in "dog leg" piping connections to press.

—with BARCO TYPE IBRA REVOLVING JOINTS



Barco Revolving Joints are used for rotary water connections on this 60" rubber mill.

BARCO *Manufacturing Co.*

510B HOUGH STREET BARRINGTON, ILLINOIS

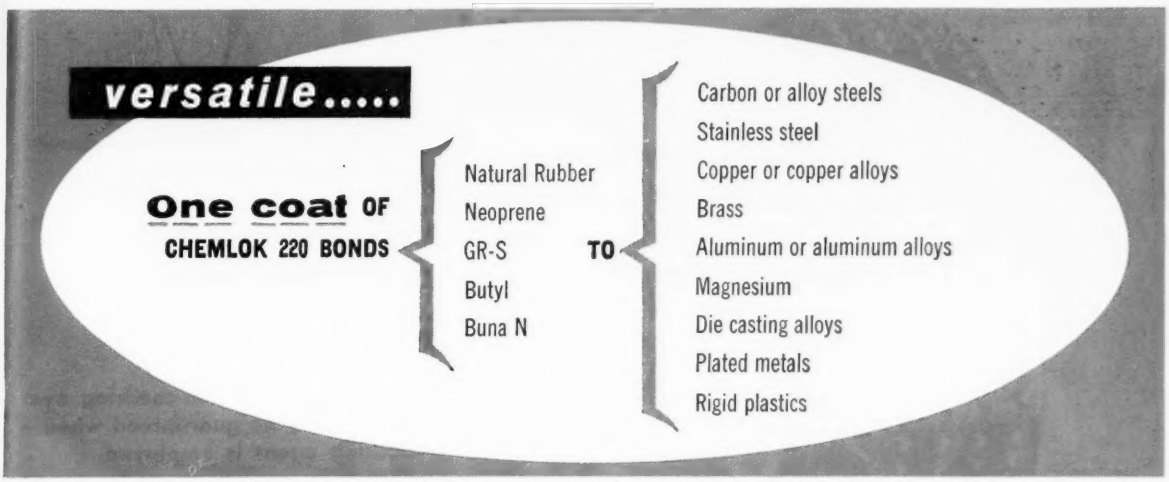
new!

CHEMLOK 220 AND 201 ADHESIVES

for bonding uncured elastomers to metals

CHEMLOK 220 remarkable one-coat adhesive out-performs conventional two-coat adhesive systems.

CHEMLOK 201 used as primer with CHEMLOK 220—gives exceptional environmental resistance.



ONE-COAT APPLICATION—A single coat of CHEMLOK 220 is sufficient for most bonding applications. Bond strength normally exceeds that obtained with conventional two-coat adhesives.

SIMPLIFIED MANUFACTURING—Adequate bonds are possible under a wider range of manufacturing conditions than ever before—metal surface preparation is minimized. Adhesive inventory may be considerably reduced.

ECONOMY—One-coat application means less adhesive is used, less labor, less processing time. Exceptional bond strength means less scrap loss, better service life. Easy processing saves manufacturing cost.

ENVIRONMENTAL RESISTANCE—Superior resistance of the bond to heat, hot and cold water, salt spray, chemicals, electro-plating solutions, solvents and corrosive atmospheres is obtained with CHEMLOK 201 as primer with CHEMLOK 220.

For detailed information on CHEMLOK *220 and 201, mail coupon or write for evaluation samples.*

CHEMLOK ADHESIVES

SPECIAL PRODUCTS DIVISION
LORD MANUFACTURING COMPANY
Erie, Pennsylvania

Lord Manufacturing Company
Special Products Div., Erie, Pa.

Please send me product data on CHEMLOK 220 and 201.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

FOR MAXIMUM SUN-CHECKING PROTECTION

Specify Original Formula

"ANTISUN"*

by

CARY

*Registered Trade Mark

Maximum protection against sun-checking over extended periods can only be guaranteed when a top-notch sun-checking agent is employed.

Cary "Antisun",

formulated of the finest quality ingredients and proven so satisfactory in tire compounding, mechanical goods, insulated wire and cable compounds, is still the same basic formula developed by our President years ago.

- Recommended usage: 2-4% of the weight of the rubber hydrocarbon, depending on the degree of protection desired.
- Unlimited Availability.
- Low Cost.
- Available in convenient chipped or slabbed forms.

Accept no substitute for this time-tested, highest quality product — CARY "ANTISUN".

Cary Chemicals Inc.

P. O. BOX 1128, NEW BRUNSWICK, NEW JERSEY

Laboratory and Plant: RYDERS LANE, MILLTOWN, NEW JERSEY

CHarter 9-8181

CARY CHEMICALS PRODUCTS:

- Vinyl Plasticizers
- Vinyl Compounds
- Sun Checking Waxes
- Gilsonite Compounds
- Reclaiming Oils
- High Melting Point Synthetic Waxes
- Tall Oil Esters

Canadian Representative: Lewis Specialties, Ltd., 1179 Decarie Blvd., Montreal 9, Que.

In 1957

UNITED CARBON BLACKS

will serve you well!

DIXIE 35

Dixie 35 (GPF), general purpose furnace, is a remarkably versatile black with properties streamlined in keeping with today's demands.

Dixie 35 was purposely developed to provide the easy mixing, fast processing, and increased reinforcement normally derived from the use of more than one type black.

Dixie 35 has also other desirable features, such as high resiliency, low heat build-up, good flex resistance, and of course exceptional uniformity.

United blacks are quality blacks commanding confidence everywhere because they do such an excellent job.

For product recognition, specify United. You stand to gain so much.

UNITED CARBON COMPANY, INC.

A subsidiary of United Carbon Company

CHARLESTON 27, WEST VIRGINIA

NEW YORK AKRON CHICAGO
BOSTON LOS ANGELES MEMPHIS

IN CANADA: CANADIAN INDUSTRIES LIMITED

In 1957

UNITED
CARBON
BLACKS

will serve you well!

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A subsidiary of United Carbon Company

CHARLESTON 27, WEST VIRGINIA

NEW YORK	AKRON	CHICAGO
BOSTON	LOS ANGELES	MEMPHIS

IN CANADA: CANADIAN INDUSTRIES LIMITED

HOW TO GET HIGHER MODULUS WITH HI-SIL® 233

Since the introduction of Hi-Sil 233 to the trade two years ago this month, there has been an overwhelming shift to this newer reinforcing silica from our original product, Hi-Sil 101.

Despite the lower cost of Hi-Sil 233, some compounders have been reluctant to convert their recipes because of the slightly lower modulus imparted by this pigment. This has been particularly the case with certain nitrile compounds, especially some of those designed for oil field supplies.

To provide all the advantages of lower cost and considerably improved strength properties for such uses, a rather extensive laboratory study has been completed to determine suitable methods for increasing modulus of nitrile stocks.

The results of this work are now in print as Hi-Sil Bulletin No. 11. Four techniques are reported for raising modulus of Hi-Sil 233—nitrile formulations.

This bulletin is available on request, along with fresh samples of Hi-Sil 233 if your laboratory supply is running low. Please address your inquiries to Room 1929-W at Pittsburgh, or any of the district sales offices.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: Cincinnati • Charlotte • Chicago • Cleveland
Boston • New York • St. Louis • Minneapolis • New Orleans • Dallas
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IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

KO-BLEND...
the best way known
to assure
flawless whitewalls

In white sidewall stock,

KO-BLEND

is your protection against

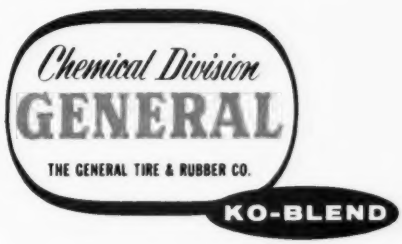
- SULFUR BLOOM
- POOR SULFUR DISPERSION
- MOLDING DEFECTS

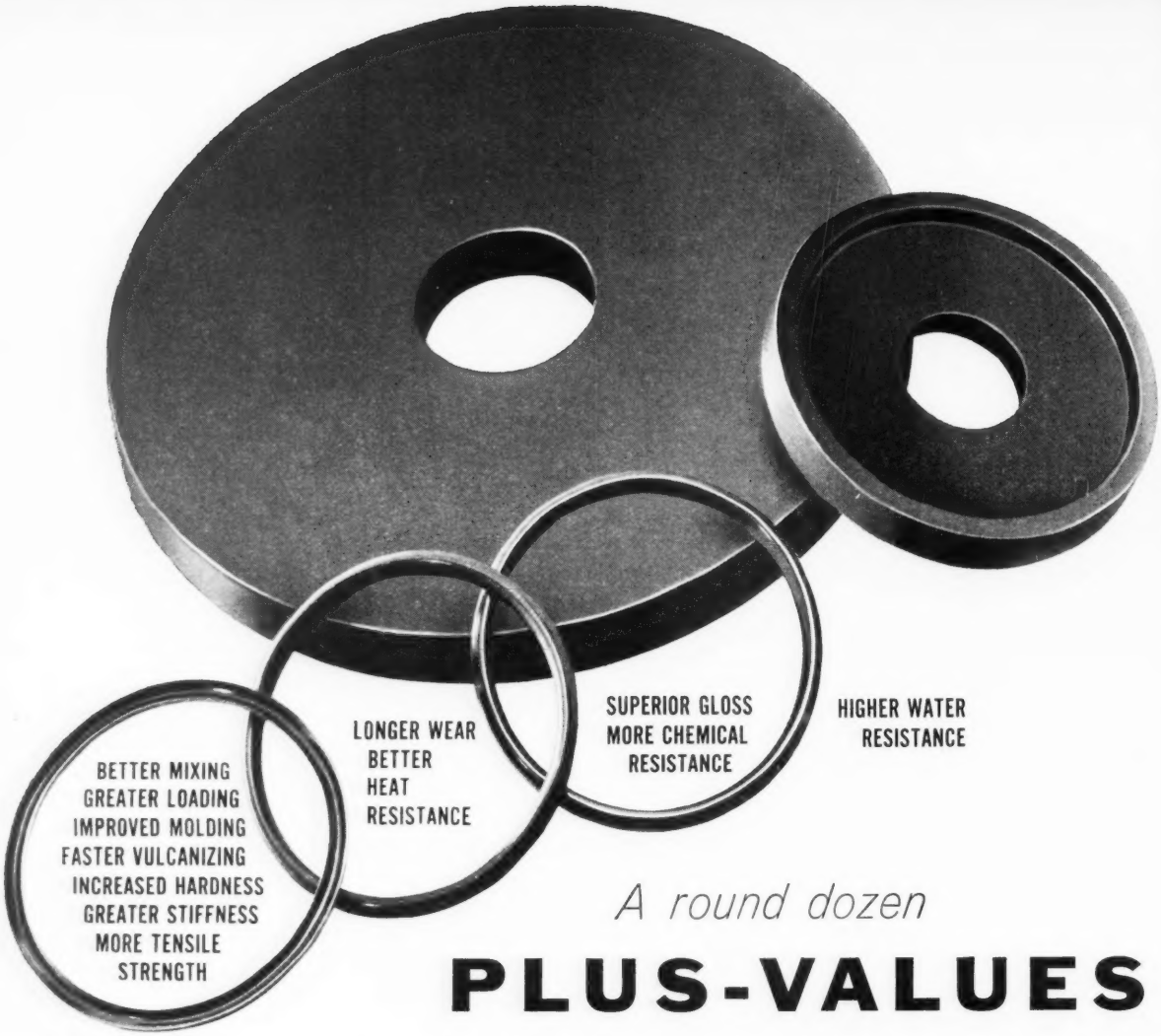
For less than ½¢ per whitewall tire you can add the small amount of Ko-Blend necessary to reduce rejects and reworks to a minimum. Ko-Blend is a latex-compounded masterbatch containing 85% insoluble sulfur which has been colloidally dispersed in GRS latex.

The extremely short milling time necessary to incorporate Ko-Blend makes it possible to maintain high Mooney viscosity in whitewall stocks while overcoming processing difficulties encountered when other types of sulfur are used. For samples and further information on how Ko-Blend eliminates spots, streaks and batch softening, write to:

THE GENERAL TIRE & RUBBER COMPANY
Chemical Division
AKRON, OHIO

Creating Progress Through Chemistry





A round dozen

PLUS-VALUES

for hard and semi-hard Buna-N stocks

● Discover the impressive effects Durez phenolic resins can have on your operations . . . in improved processing, in enhanced end-product properties.

For example, we list above the benefits being obtained with a group of these resins developed for incorporation with Buna N's. The resins are completely compatible with synthetic rubber of this type and serve as plasticizers at processing temperatures. Owing to chemical reactivity, they contribute strongly to vulcanization, reinforcement, hardness, stiffness, abrasion resistance, and other characteristics desired in hard and semi-hard Buna N stocks.

Other Durez phenolic resins are recommended for specific advantages . . . with GRS in shoe sole and heel stocks, with natural rubber and Neoprene molding compounds, and in both air-dry and thermosetting adhesives.

Our experience as pioneers in perfecting resins for the rubber industry is at your service. For more information on how they can help to solve specific problems, write, giving details please.

DUREZ®

Phenolic Plastics for the Rubber Industry

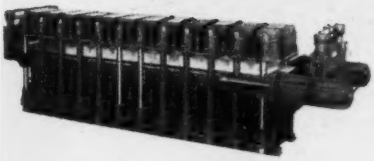
DUREZ PLASTICS DIVISION

HOOKER CHEMICALS PLASTICS

HOOKER ELECTROCHEMICAL COMPANY
201 WALCK ROAD, NORTH TONAWANDA, N. Y.

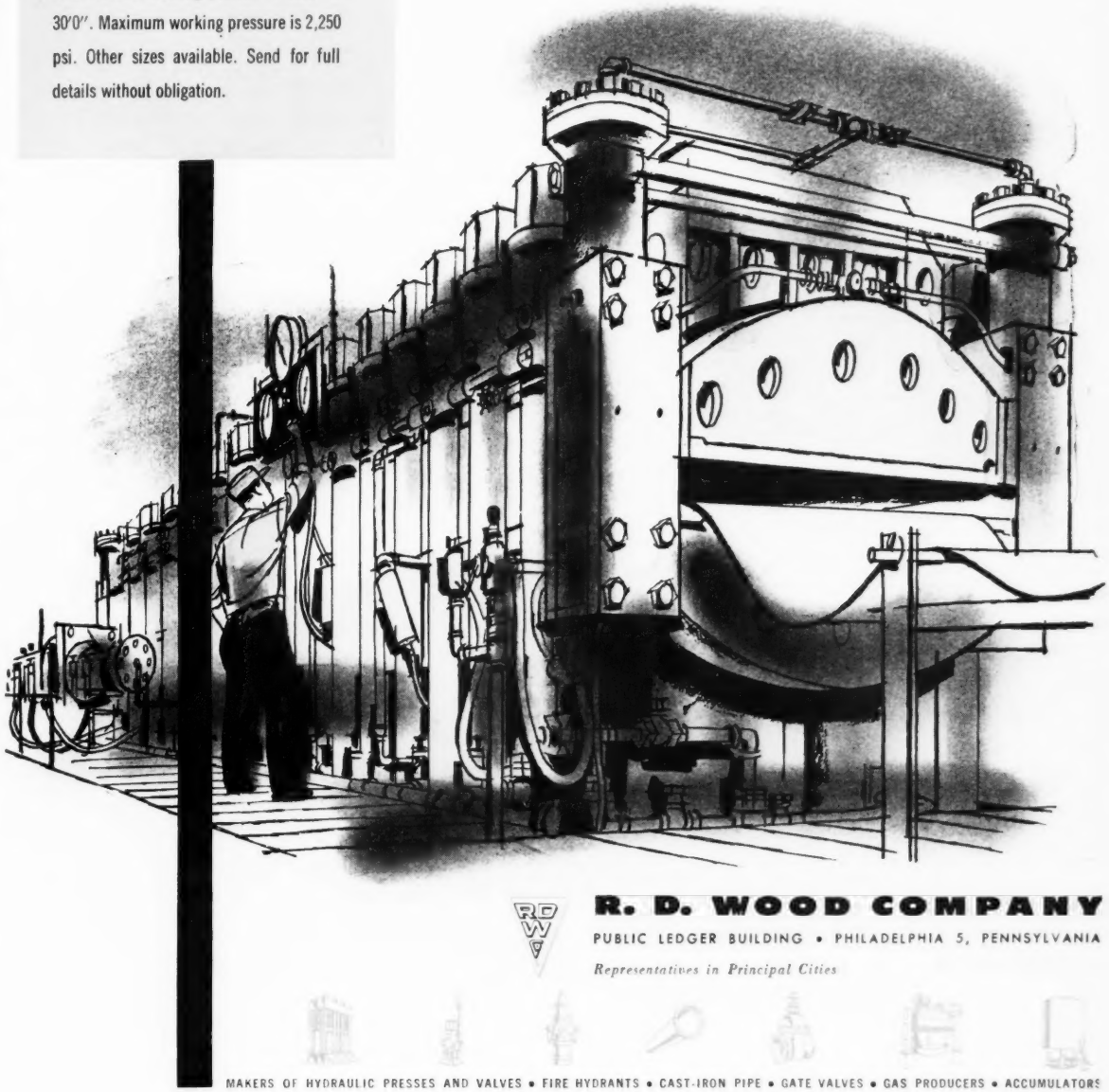
Export Agent: Omni Products Corp., 460 Fourth Avenue, New York 16, New York

The standard by which other presses are judged



Single Opening Belt Press for vulcanizing rubber belting. Press is equipped with hydraulic stretcher and clamping units mounted at the ends of the moving platen to maintain tension on belt while it is being processed. Press capacity is 3,180 tons. Size of heating platens is 63¼" x 30'0". Maximum working pressure is 2,250 psi. Other sizes available. Send for full details without obligation.

The proof of any press is its performance: excellence invariably shows up in service. How to be sure of quality when you choose a press? Simply look for the name 'R. D. Wood' on the nameplate. During more than 150 years, this name has never appeared on a press of inferior quality. In every R. D. Wood press, meticulous design, select materials, scrupulous craftsmanship combine to give you over-all efficiency, operating ease, production economy and long service. Write for engineering data on R. D. Wood presses for the rubber industry.

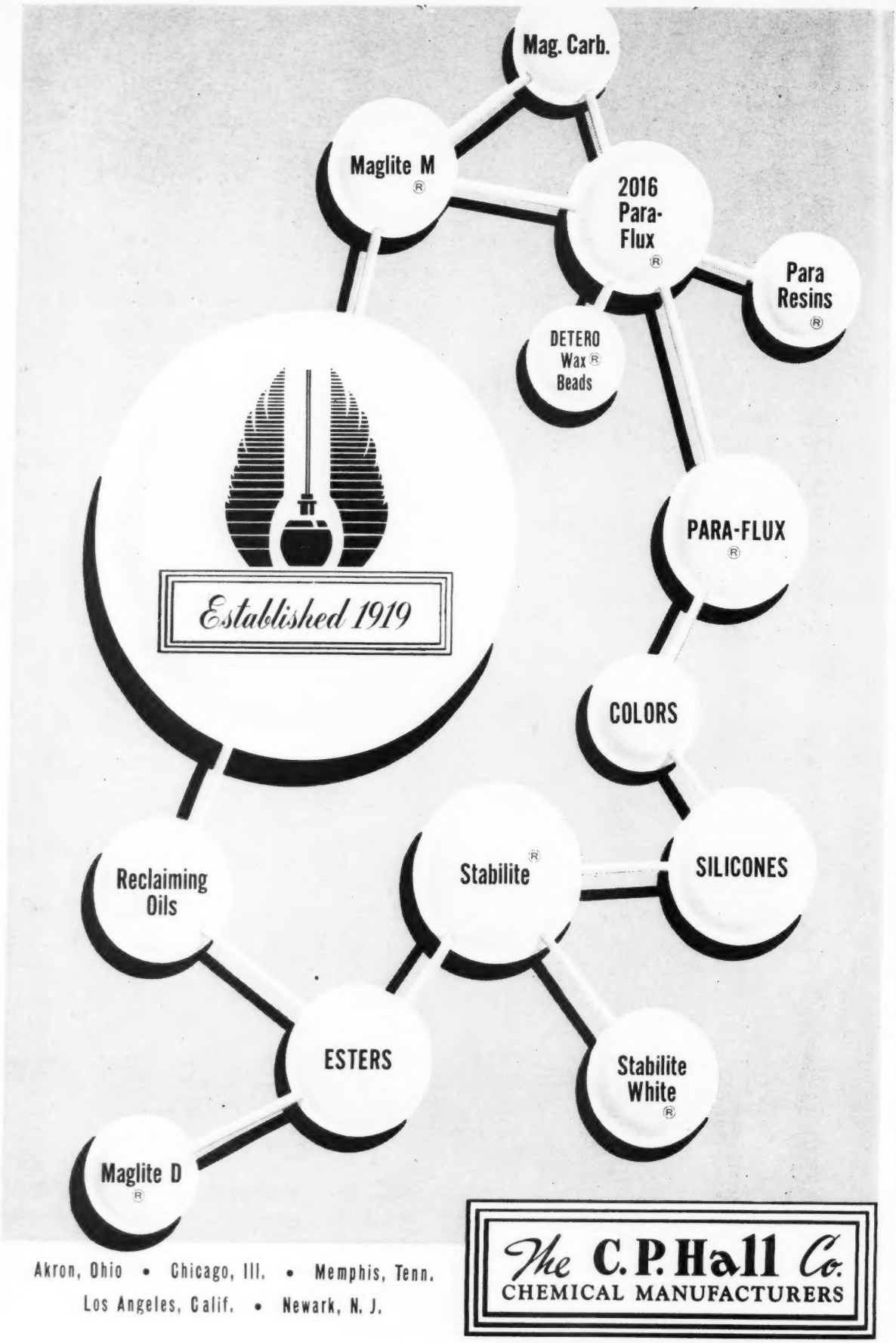


R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Representatives in Principal Cities

MAKERS OF HYDRAULIC PRESSES AND VALVES • FIRE HYDRANTS • CAST-IRON PIPE • GATE VALVES • GAS PRODUCERS • ACCUMULATORS



Akron, Ohio • Chicago, Ill. • Memphis, Tenn.
Los Angeles, Calif. • Newark, N. J.

The C. P. Hall Co.
CHEMICAL MANUFACTURERS

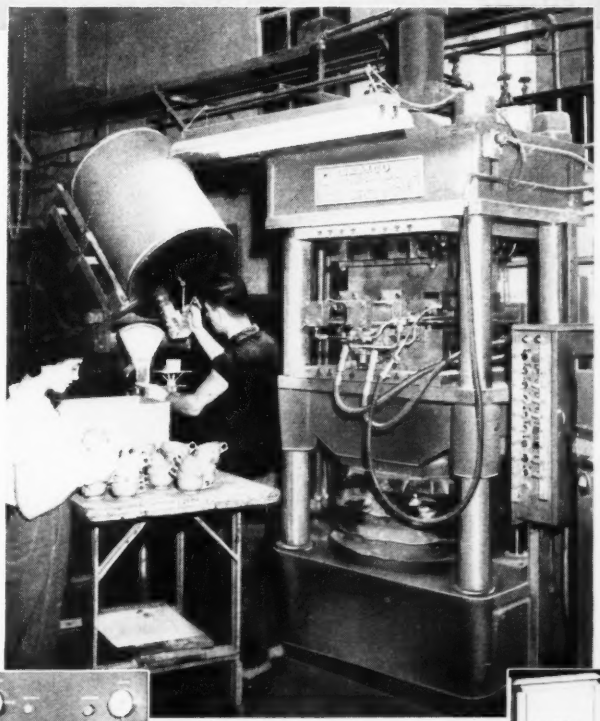
ONE OF A BATTERY OF PRESSES

now being installed at APPLIED PLASTICS

Built and Designed by ERIE ENGINE & MFG. CO.

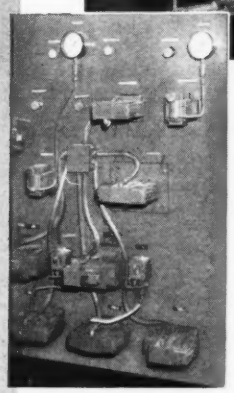
Here is one of a line of EEMCO Hydraulic Presses especially designed and built by Erie Engine & Mfg. Company to fit the particular needs of the Applied Plastics Company's operation. Due to the many different jobs common to a custom molding shop, they needed presses which were adaptable to various cycles of compression molding and transfer molding. These presses are designed to handle any job and operate automatically.

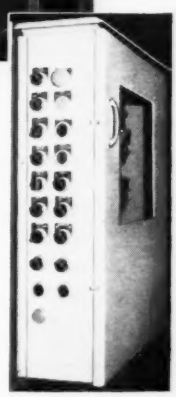
The set-up man adjusts pressure required, speed of closing, opening speed and the required timing cycle. All the operator does is press a button for start of cycle.



"Production increased . . . fewer rejects" says
LLOYD MOORE
Pres., APPLIED PLASTICS CO.
ERIE, PA.

"We find that our EEMCO presses have increased production and cut down rejects. The human element of error has been practically eliminated through the automatic cycle and pressure controls, which also allow for more constant quality and more productive work schedules. Less skilled operators are now able to turn out a steady flow of first quality work in less time."





Pictured above is one of the EEMCO Presses installed at Applied Plastics. This press has platen area of 36" x 36" and capacity of 314 Tons.

EEMCO can help you, whether you need 1 press or a battery of presses—with or without controls.

In addition to standard size presses, EEMCO designs and builds units to meet your specifications.

PRESSURE CONTROL

Controls fast closing speed—allows complete flexibility of pressure adjustment to suit each job.

CYCLE CONTROl

Controls may be set for automatic operation of the cycle desired—for either compression or transfer molding.

EEMCO

Write or wire for complete details.

ERIE ENGINE & MFG. CO.

951 EAST 12TH STREET, ERIE, PA.

Designers and builders of a complete line of Mills and Hydraulic Presses for the RUBBER, PLASTICS, FIBERGLASS and WOOD PRODUCTS INDUSTRIES.

look...

it's

TITANOX*

Rutile types of TITANOX white titanium dioxide pigments are universally acceptable for most types of plastics—whether extruded, molded, sheet, or film-coated. For white and light tinted stocks, TITANOX-RA provides maximum whiteness, brightness and opacity. For heavily loaded stocks where the high opacity of "pure" titanium dioxide is not needed, TITANOX-RCHT or TITANOX-C-50 may be used.

But whatever the use, no other whitening agent gives plastic products the color and sparkle—the eye-catching appearance—that TITANOX does. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta 5; Boston 6; Chicago 3; Cleveland 15; Houston 2; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 14, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

*TITANOX is a registered trademark for titanium pigments sold by Titanium Pigment Corporation.

Titanium Pigment Corporation is a subsidiary of National Lead Company

3646-B

COPO

means pioneering in cold rubber...

and now we are proud to offer the result of our latest development, COPO 3900. A non-staining polymer whose particular physical properties make it especially well-suited for the manufacture of such items as shoe soles and heels, floor tile, appliance and drop cord, and molded and extruded goods. It is priced lower than most standard grades of polymers.

uniformity • good service • high quality • well-packaged

COPOLYMER RUBBER & CHEMICAL CORPORATION • BATON ROUGE 1, LOUISIANA COPOLYMER CRCC RUBBER & CHEMICAL CORPORATION COLD RUBBER SPECIALISTS

close temperature control

flood lubrication

efficient zero clearance

low maintenance

the points add up

. . . add up to extremely high efficiency coupled with absolute economy. Press the control button of a Shaw Calender and you receive a sum of all the experience, productive facilities, research results, and specialized knowledge concentrated in one grand total—better production.

The machine illustrated is a 4-roll inverted L type with each roll driven by its own variable speed motor through a unit gearbox.

the sum total of experience *

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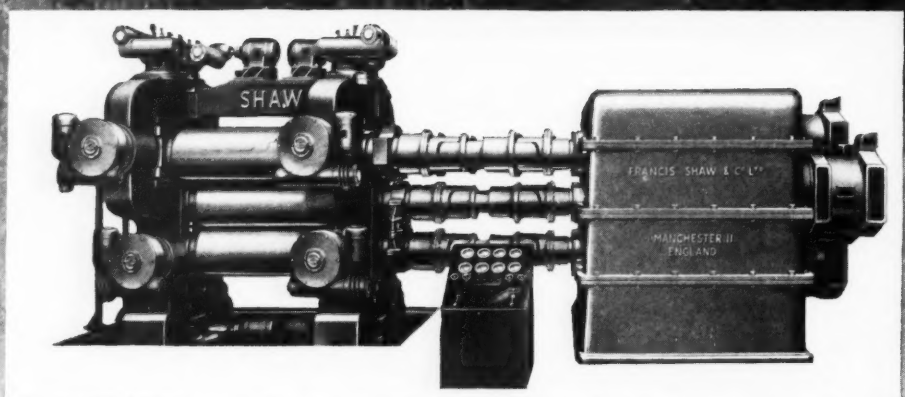
Industry's headquarters for the best in Rubber & Plastics machinery



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For Any Rubber and Plastic compounding Requirement . . .

For faster pigment incorporation, cleaner color and more color permanence in the finished product —

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Color dispersed in plasticizer for organosol, plastisol and calendered vinyl resins.

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Dry Colors — All colors for all purposes.

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Polyester Paste Colors–

Pigments selected for maximum heat and light stability and CUSTOM-MATCHED to your exact color requirements in polyester resins.

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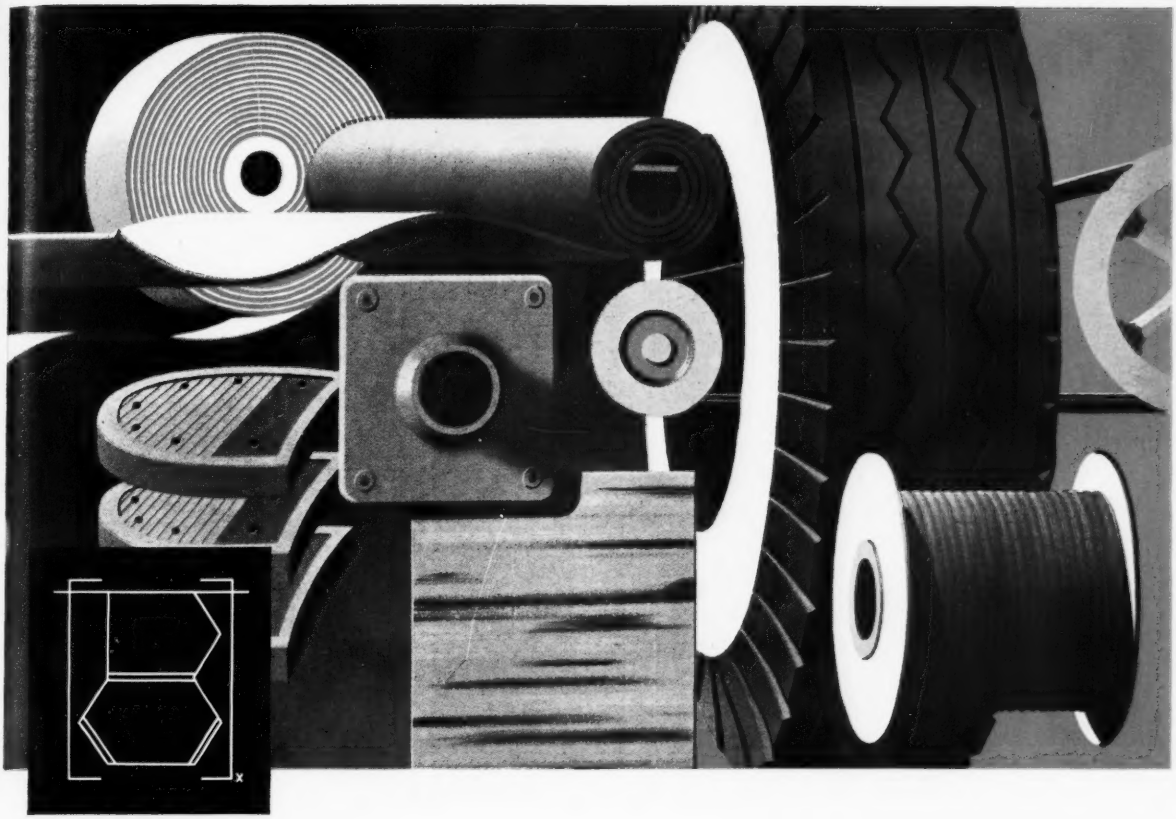

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Coumarone-indene resins by Neville have become standard in the processing of rubber for an ever-increasing variety of products in ever-greater volume throughout the years. Here's why. Users find that Neville gives them constant good quality and fast service, and they save production time and costs and produce better products when they use coumarone resins. Also, Neville has a broad variety of these ideal extender-plasticizers in various grades and melting points to suit every product need. Our chemists will gladly assist yours in selecting the proper one for your purpose. Use the coupon to write for further information.

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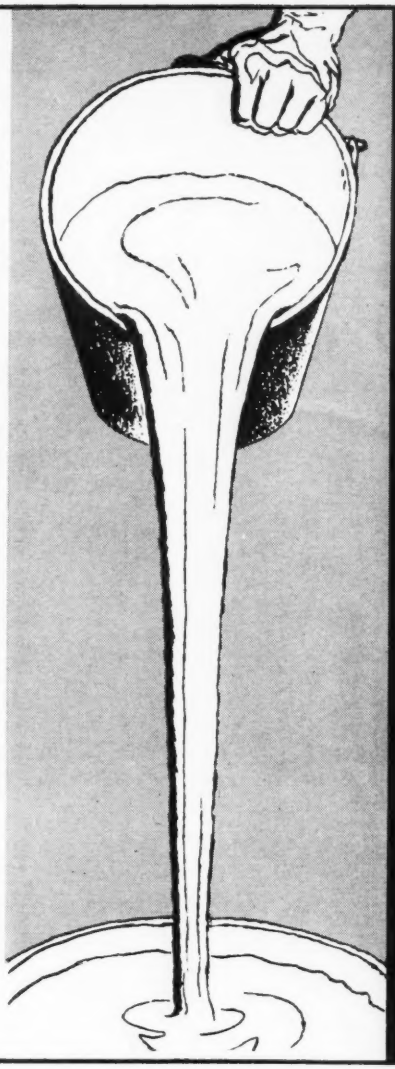

the thickener that pours easily!

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You're likely to find an ideal combination of advantages when you thicken latex with Modicol VD. For this synthetic polymer gives uniform high viscosity . . . smooth and gel-free . . . even at very low concentrations.

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PLANTS: Harrison, N. J.
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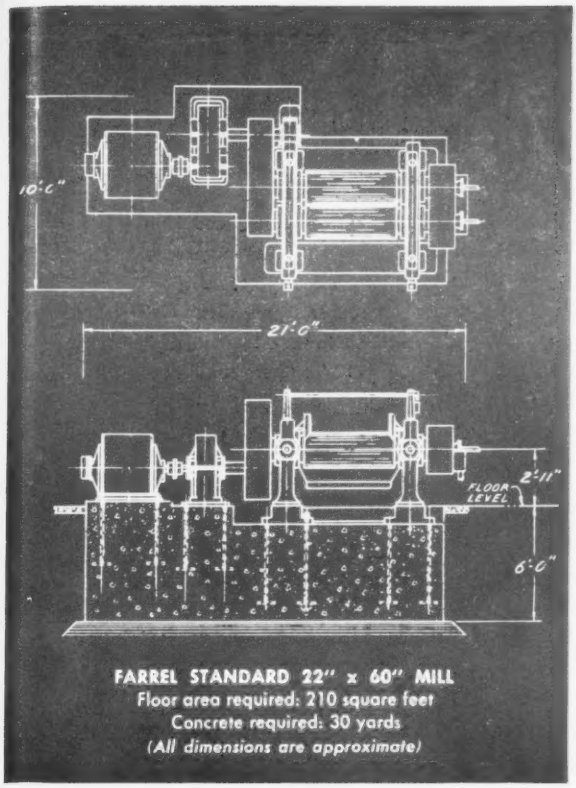
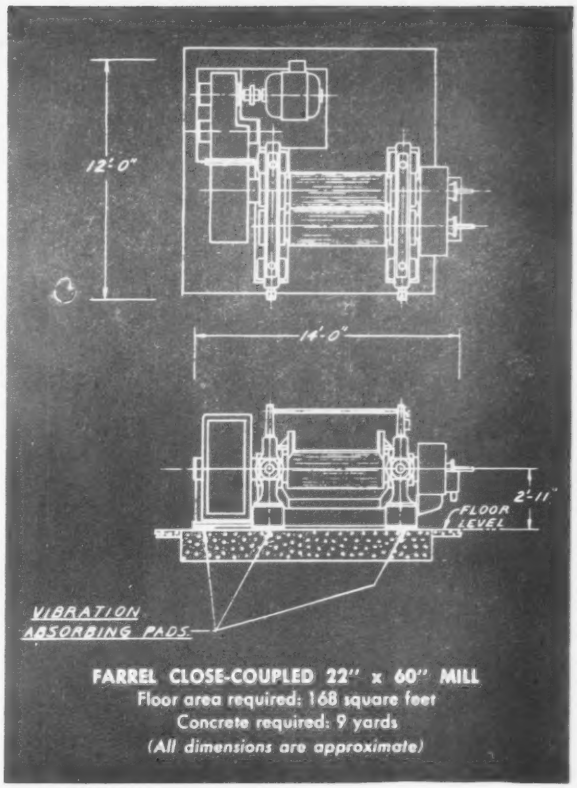


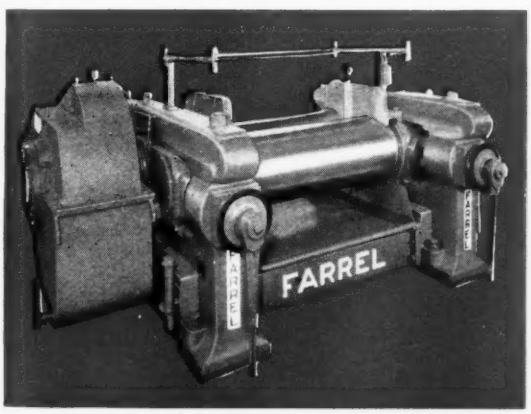
FARREL STANDARD 22" x 60" MILL
Floor area required: 210 square feet
Concrete required: 30 yards
(All dimensions are approximate)



FARREL CLOSE-COUPLED 22" x 60" MILL
Floor area required: 168 square feet
Concrete required: 9 yards
(All dimensions are approximate)

NEW MILL SAVES VALUABLE SPACE

Farrel® close-coupled unit costs less to install ... saves floor area and foundation yardage



This new Farrel close-coupled mill comes complete with oil reservoir, and is arranged for floor mounting on vibration-absorbing rubber pads. Triple-reduction gear drive, driving motor and mill are a self-contained unit. Also available in 26" x 84" size.

Compare the diagrams above, and you will see some of the many advantages of Farrel's new concept in mill design – the 22" x 60" close-coupled unit.

You save space! 42 bonus square feet of mill floor space are made available by the new Farrel mill. That's because the reduction gearing is integrated in one case, without the usual bull gear and pinion. Driving motor may be inboard or outboard as desired.

You save foundation yardage! 21 fewer yards of concrete are needed to install the close-coupled mill. Foundation bolts are not required since load reactions are resolved within the close-coupled assembly.

You save on installation cost! The close-coupled mill is completely self-contained mechanically, simplifying installation and relocation of the unit. Levelling screws on bed provide for installation levelling on mill floor. No projections of mill or drive below floor level – no costly special foundation.

Write for complete information.

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Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
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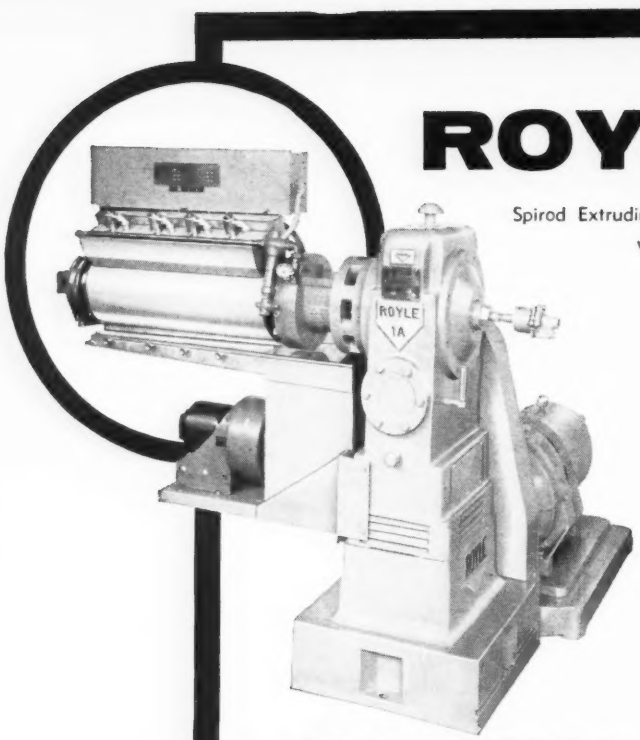

ROYLE 1A (2½" cylinder bore)

Spirod Extruding Machine with electric heating and high velocity evaporative cooling. An all-purpose extruding machine for processing rubber and plastics.
Available in sizes 1⅛" through 12" cylinder bore.

Strainers, Cooling Troughs, Light Wire and Cable Capstans, Motorized Take-ups, Temperature Control Units.

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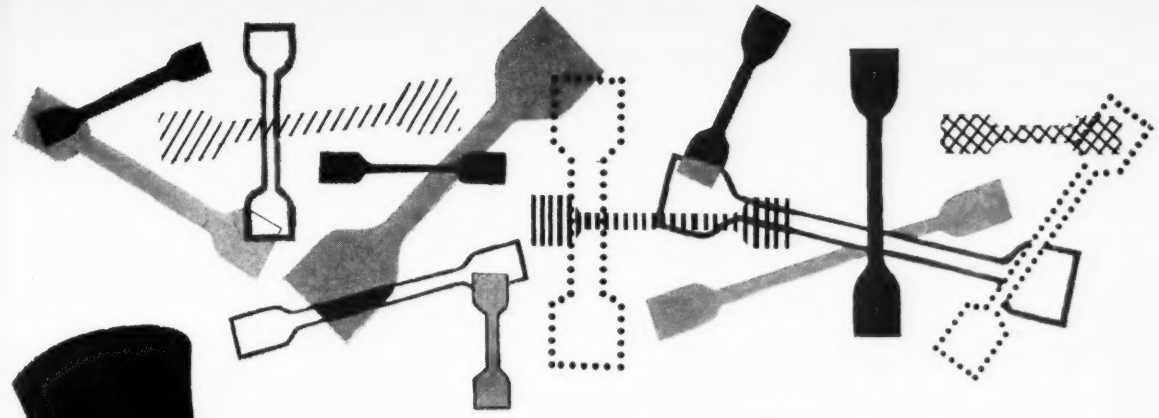

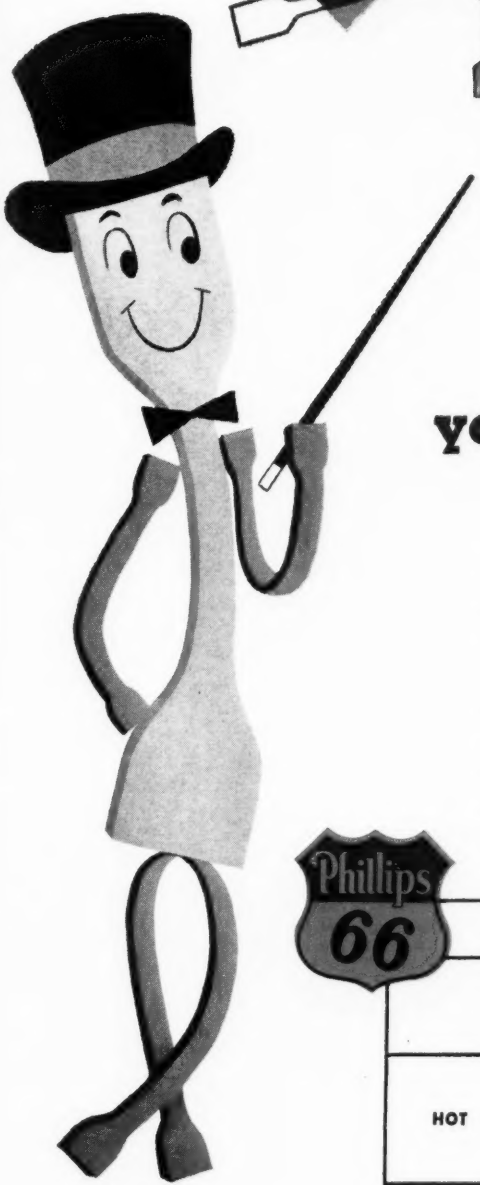

16 different Philprene* rubbers to fit your special requirements!

That's right! There are 16 non-pigmented and pigmented Philprene polymers to choose from! That means you can select a Philprene that's tailor-made for your purpose . . . one which will give you the physical characteristics and processing qualities you need in your product and is best suited to your manufacturing facilities.

And to help you select that Philprene, Phillips maintains a practical, technical advisory service. Call our technical representative for a consultation on your problems. We are glad to assist you in the efficient and profitable use of Philprene. What is good business for you is good business for us, too, so don't hesitate to let us know how we can be helpful.

Phillips 66

	CURRENT PHILPRENE RUBBERS	
	NON-PIGMENTED POLYMERS	PIGMENTED WITH PHILBLACK*
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COLD	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503	PHILPRENE 1601 PHILPRENE 1605
COLD OIL	PHILPRENE 1703 PHILPRENE 1706 PHILPRENE 1708 PHILPRENE 1712	PHILPRENE 1803

PHILLIPS CHEMICAL COMPANY
Rubber Chemicals Division
318 Water Street, Akron 8, Ohio

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A NEW CONCEPT IN LABORATORY MILL DESIGN

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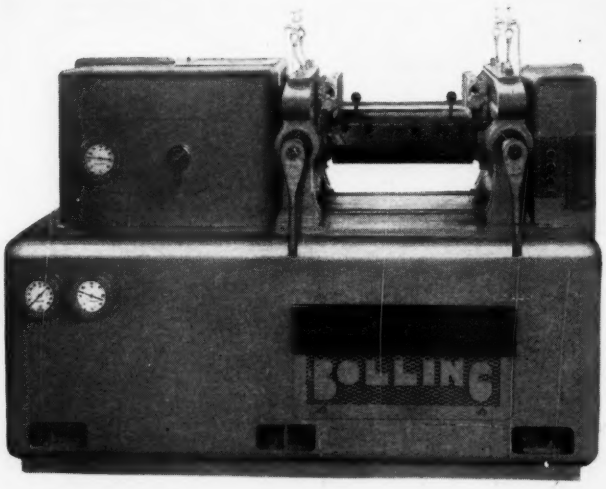

Write for Catalog Data Sheets illustrating our complete line of laboratory equipment.

Ten Bolling laboratory mills in sizes from 6" x 16" to 16" x 36" were installed during 1955 in the world's largest and most modern rubber laboratory. One of these mills, an 8" x 20" deluxe model, is shown above.

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Vulcanized Oil

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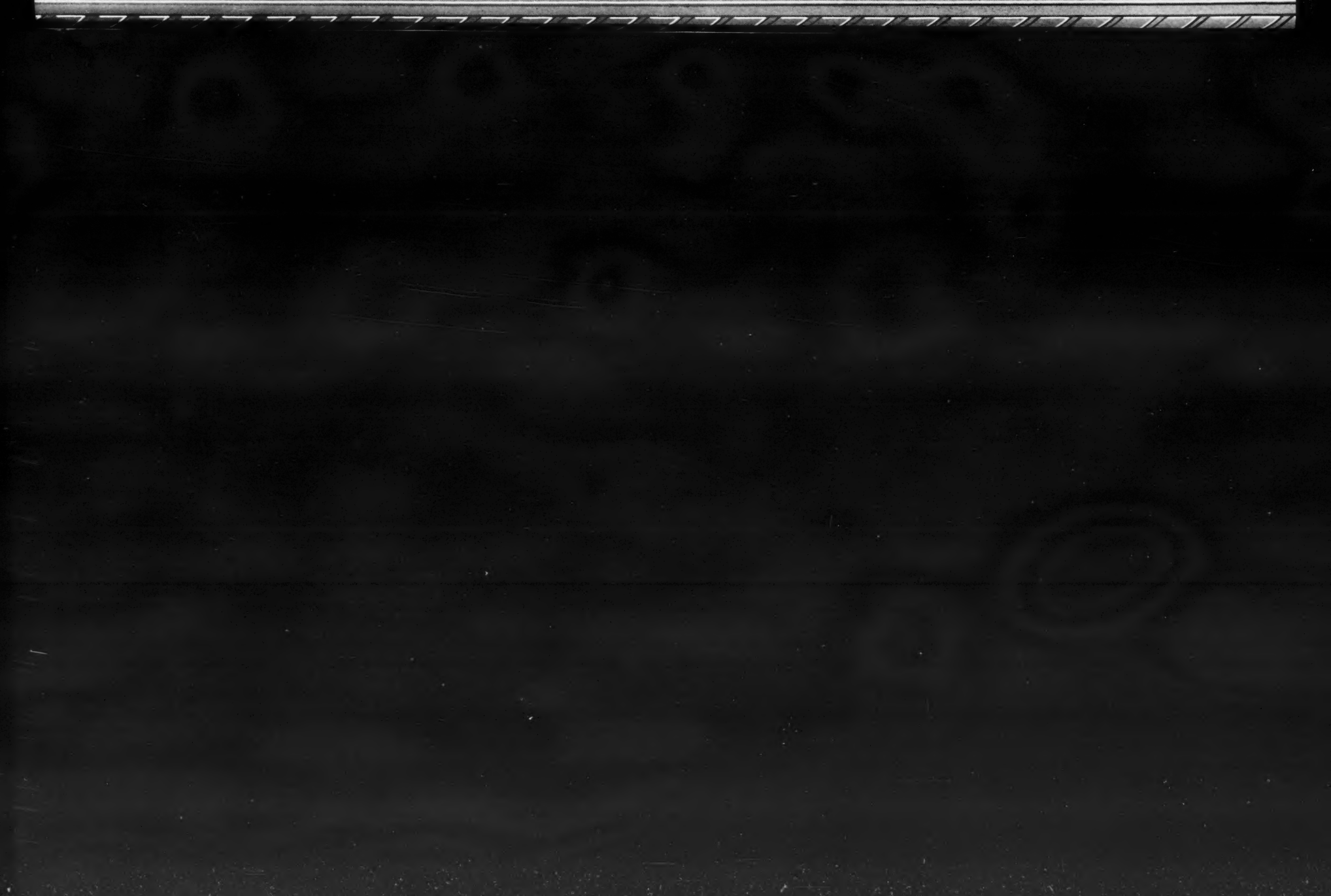

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Diisopropyl benzothiazyl–2-sulfenamide

DIPAC* is a new delayed action accelerator designed for modern high temperature processing equipment where maximum freedom from scorch is essential.

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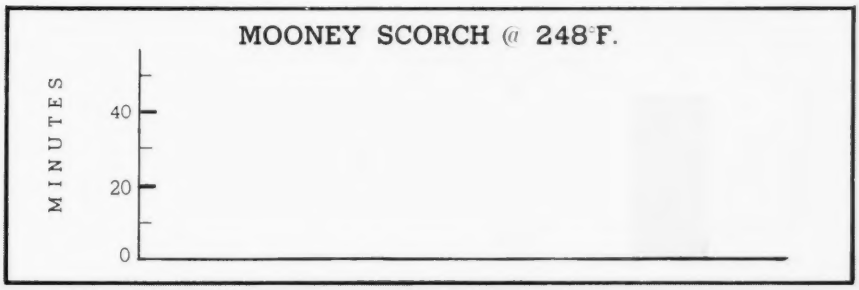
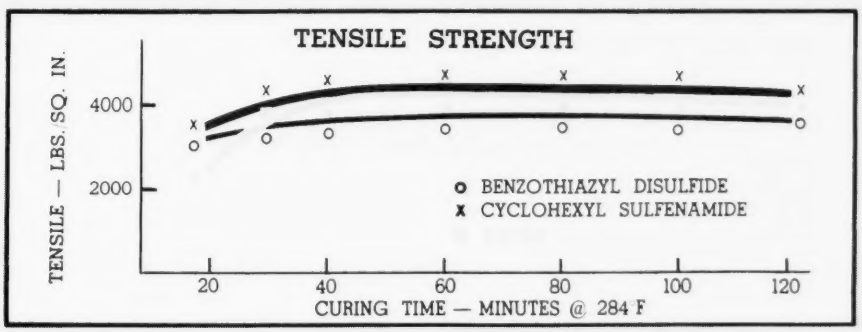
Benzothiazyl Disulfide	0.80	—	—
Cyclohexyl Sulfenamide	—	0.50	—
	—	—	
Totals	165.05	164.75	164.75





Technical information and samples are available on request.

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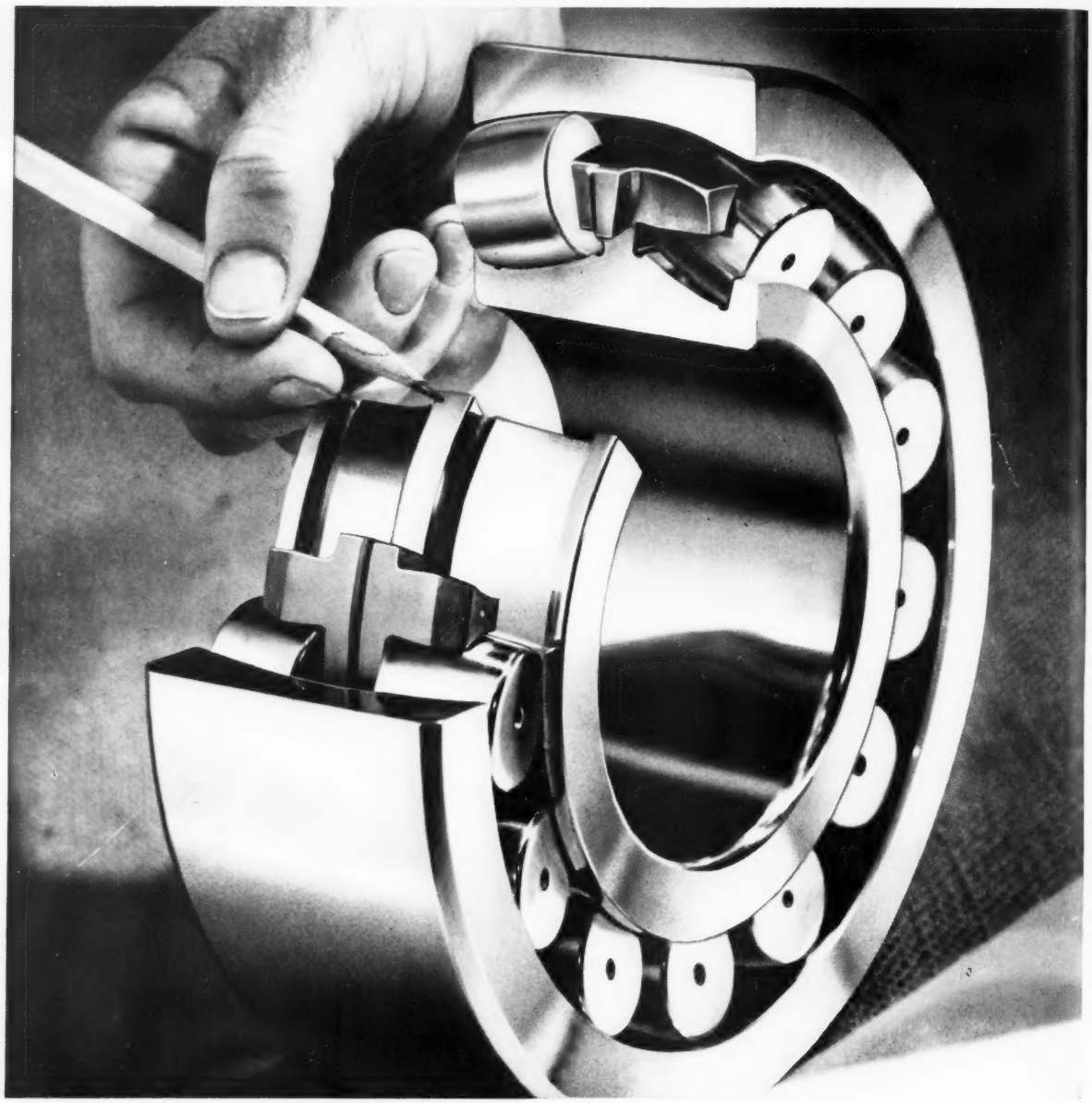
TORRINGTON *SPHERICAL ROLLER* BEARINGS



"This flange guides the rollers to peak performance!"

The center flange on the inner raceway of the TORRINGTON Spherical Roller Bearing positions the rollers to handle thrust loads. This accurate positioning also assures radial stability of the rollers under heavy loads—even at continuous high speeds and under conditions of misalignment.

This superior design feature is only one of many advantages you get when you specify TORRINGTON. For example, you get the service of TORRINGTON'S experienced engineers, who will help you with design and maintenance problems—or design custom bearings for special applications.

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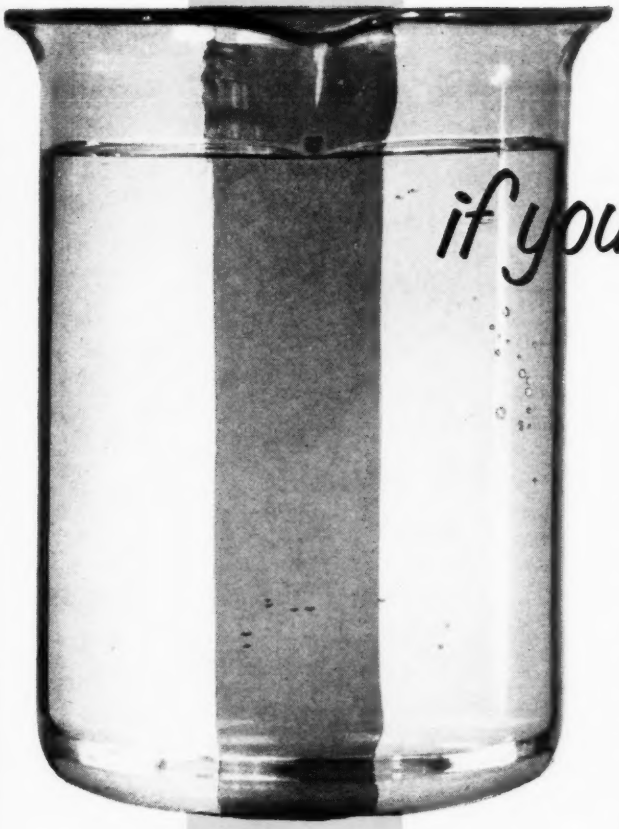

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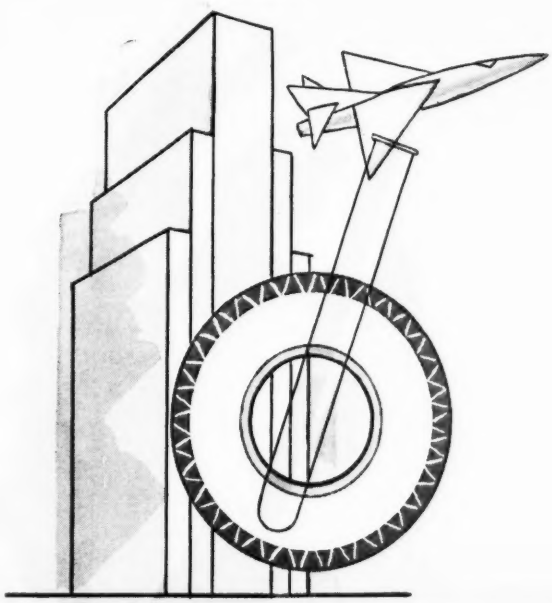
We will be pleased to furnish samples, specifications, price and delivery quotations.



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Types, grades and blends
for every purpose, wherever
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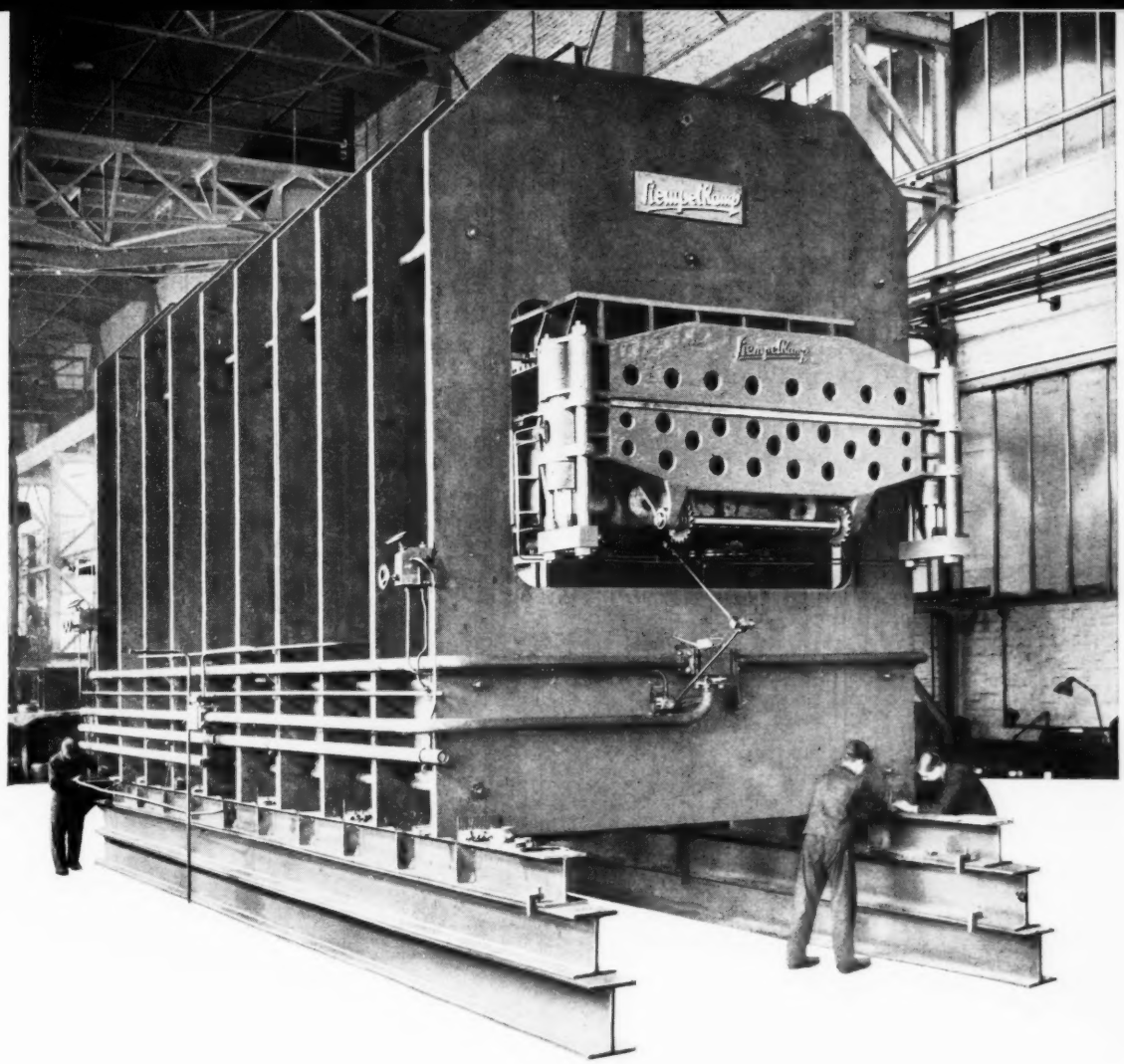

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Dimensions up to 600 ins. by 128 ins.

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suspended in a free static condition as required by

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Exact determination of modulus

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Designed for accurate operation by non-technical personnel. Operator simply revolves the additive weight control wheels to the number corresponding with the thickness number observed on the sample thickness gage—additive weight loading automatically follows.

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4 stress ranges available: 50, 100, 200 and 400 lbs. psi.

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does not mean cotton fiber alone

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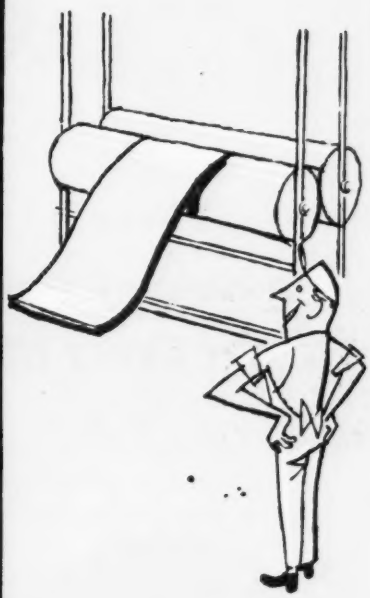
SPECIALLY-PROCESSED BUTADIENE-STYRENE COPOLYMERS

Naugatuck uses only acid as a coagulant rather than salts which tend to remain and absorb moisture in the rubber.

While still wet, the coagulated polymer is strained to squeeze out all the acid serum.



After drying, the polymer is again strained and milled to insure cleanliness and uniformity. Milling also aids subsequent processing.

Specially Processed for Low Moisture Absorption

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A stabilizer or antioxidant is added to each NAUGAPOL® prior to flocculation to protect it against oxygen deterioration and heat degradation.

Contact your nearest Naugatuck representative regarding these premium-grade GR-S elastomers.

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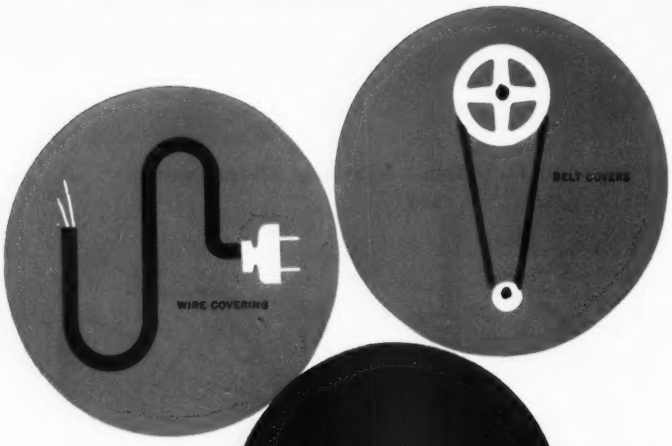

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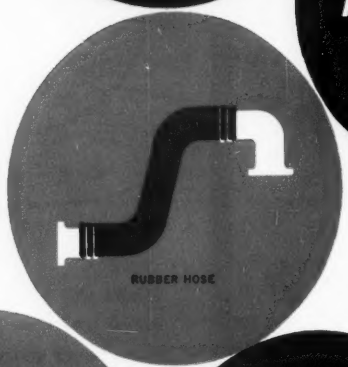

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RUBBER WORLD

EDITORIAL

JANUARY, 1957

Three Threats to Rubber Industry Progress

TRADITIONALLY, the editorial for this month should be devoted to reviewing the record for the year that has just passed and predicting the things that should occur in the year that has just begun. Such reviews and predictions are present already in ample volume in this issue of RUBBER WORLD, however, by virtue of our report of the annual meeting of the Rubber Manufacturers Association of November 28, and the year-end statements of leading industry executives.

Three particularly important items mentioned in these reviews and predictions deserve special attention. These items are more or less interrelated and are as follows: (1) The availability and cost of capital funds. (2) Wage-price inflation. (3) The scientific manpower deficit.

Alan H. Temple, executive vice president of the First National City Bank of New York, discussed the first item at the above-mentioned recent annual RMA meeting. Rubber goods manufacturing, as a growth industry, is concerned about the tight money situation. If capital projects are to be financed without inflation, they must be financed out of savings, and since growth and progress depend upon capital investment, the basic problem is to increase the supply of savings.

Three essentials for increasing the supply of savings were given as tax reform, preservation of the value of the dollar, and the payment of interest rates which will give the saver a better break.

Preservation of the dollar means many things, but it definitely is related to the extent of the wage-price inflation that develops in this country. Since the end of World War II, organized labor in the manufacturing and some other industries has forced upon the economy of this country a regular annual wage increase followed by price increases in the products or services of the industries involved. Wage increases are justifiable—only if accompanied by a proportionate increase in productivity.

Although it must be obvious to both industry and labor leaders that the wage-price spiral cannot continue indefinitely, both are inclined to close their eyes too often to its inherent future dangers.

Research and development have a greater influence on our lives today than any other single factor, it has been said. An increasing number of scientific and engineering workers are necessary to bring out and develop the discoveries we need to provide rising living standards for our increasing population. This point was made recently by The B. F. Goodrich Co. in releasing a study of the scientific manpower problem in the United States.

It was estimated that unless we are able to accelerate the rate by which we are training scientists and engineers, we face a cumulative inadequate supply of more than 90,000 such workers within the next 10 years. It might be another 10 to 15 years before the deficit could be made up and our economy could resume its forward progress at the present rate.

It could be that the order of presentation of these three items of importance to our national economy is in reverse with respect to their significance. If we can provide for sufficient scientific personnel, wage-price inflation can be more readily handled, and capital funds for growth will be in more adequate supply.

R. G. Seaman

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Growth Trends in the Rubber Industry[1]

By W. J. SEARS

The Rubber Manufacturers Association, Inc., New York, N. Y.

Growth of the world and United States rubber industry is measured by rubber consumption both natural and synthetic, increased output of both tire and non-tire products, corporate income after taxes, and the tremendous potential for future rubber use based on the Federal-Aid highway program which became law in 1956.

Synthetic rubber production capacity in the United States in 1960 is estimated at about 1.8 million long tons. This figure is in excess of estimated consumption of both natural and synthetic rubbers in this country in 1960, but will provide tonnage for the growing export market for synthetic rubber. New synthetic rubbers will mean more new products.

THE rubber products manufacturing industry of the world has grown tremendously since World War II and displays every potential for continued growth. The rubber product manufacturer outside the USA and Canada still depends largely upon natural rubber to support his increasing output.

World Rubber Consumption

Figure 1 shows the level of world consumption of natural and synthetic rubber for the past 10 years and an estimate of the consumption trend over the next 10 years. In the 20-year span depicted here the world's rubber consumption may increase nearly threefold.

Also shown in Figure 1 is the actual and estimated level of world natural rubber production. Significantly, there is no expectation of any substantial increase in natural rubber production in the years to come. Therefore the world's rubber products manufacturing industry must depend upon the increasing supplies of synthetic rubber to support its potential growth. Although new synthetic rubber plants are being built abroad, it seems inevitable that the synthetic rubber producing industry in the U. S. will find growing export markets.

Foreign rubber goods manufacturers must be furnished with the technical information and know-how necessary for increased synthetic rubber usage. Their dependence upon natural rubber must be diminished so that our fabricating industry can continue to obtain at reasonable prices its minimum requirements of natural rubber.

[1] Presented before the Rubber Manufacturers Association, forty-first annual meeting, New York, N. Y., Nov. 28, 1956.

The Author

W. James Sears

W. James Sears, vice president of The Rubber Manufacturers Association, Inc., studied engineering and pre-medical subjects at Georgia Institute of Technology, Ohio State University, and Wayne University, and law at the Detroit College of Law.

Mr. Sears was employed as a development engineer at the Detroit, Mich., plant of United States Rubber Co. from 1932 until 1941. He was with the Federal Government from 1941 to 1947 as deputy and then as acting director of the Rubber Bureau of the War Production Board and then as director of the Rubber Division of the Civilian Production Administration. He has been a consultant to the Economic Cooperation Administration and the National Security Resources Board. Mr. Sears has been an industry advisor at meetings of the International Rubber Study Group from 1950 through 1955.

He joined the RMA in 1947 and is also manager of the Washington office and chairman of the Association's crude rubber committee.

Mr. Sears is a member of the Division of Rubber Chemistry of the American Chemical Society; the American Society of Association Executives, Newcomen Society; Circumnavigators Club; and Sigma Nu. He is a past president of the Washington Rubber Group and vice president of the Washington Post of the American Ordnance Association.

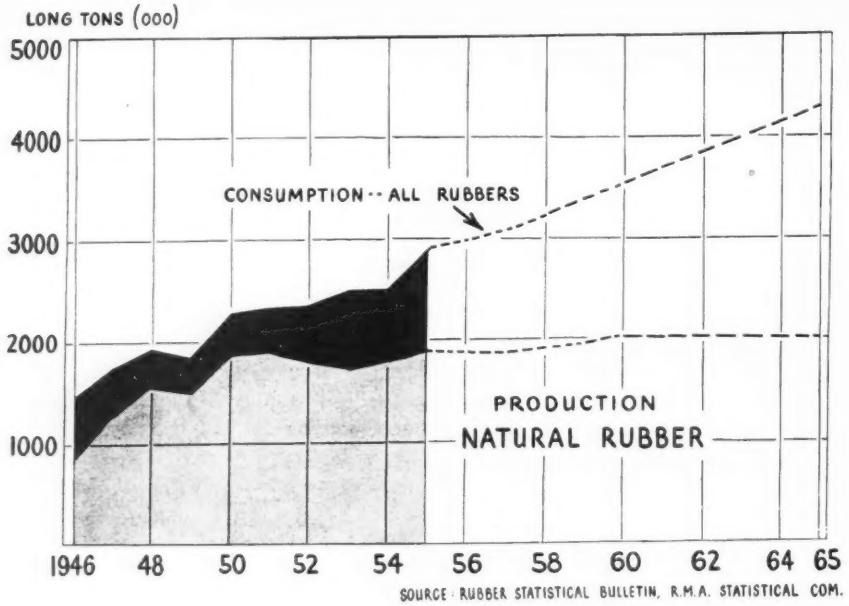


Fig. 1. World consumption of natural and synthetic rubbers and production of natural rubber, actual and estimated, 1946-1965

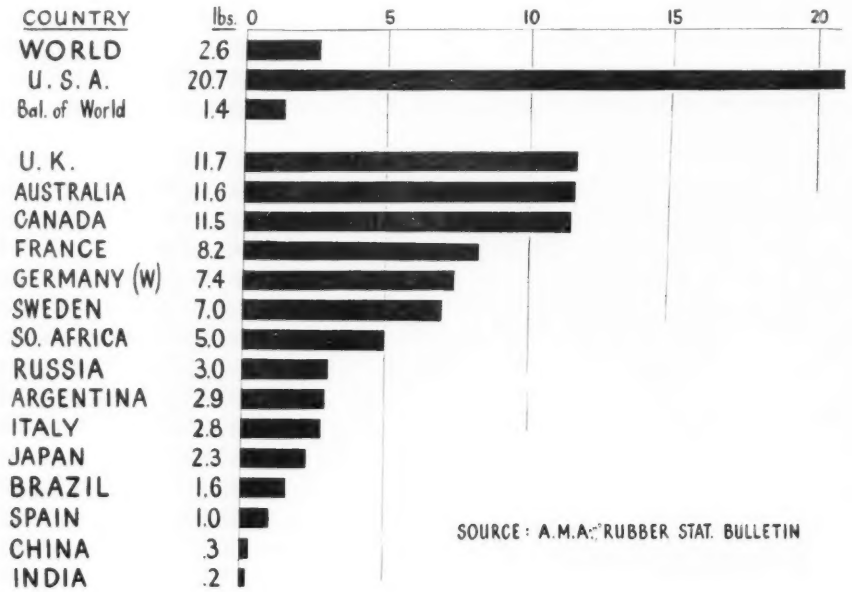


Fig. 2. New rubber consumption per capita for 1955

Consumption Per Capita—1955

Figure 2 is of interest since it dramatizes the potential for increased world rubber consumption. Here is shown new rubber consumption per capita in the principal countries of the world during 1955. This type of data is also a measure of growth trends in the rubber industry. Rubber consumption per capita in America has trebled in the past 25 years and thus has grown at a much faster rate than the population alone. You have all seen stories in national magazines and the press about the expected great increase in population. This one factor alone supports the potential growth of our industry without even allowing for the anticipated future increase in rubber consumption per capita.

On the world-wide side, a glance at this chart cannot but stir the imagination as to what the world demand for rubber might be if some of the more populous countries increased their per capita consumption by a pound or a part of a pound.

U.S.A. Total New Rubber Consumption

Now let's turn to the rubber products manufacturing industry in the United States and examine its growth trends. The record of new rubber consumption, natural plus synthetic, is the best measurement of our industry's activity. Figure 3 shows actual rubber consumption over a 25-year period alongside estimates for 1960 and 1965. For the selected past years, natural and synthetic

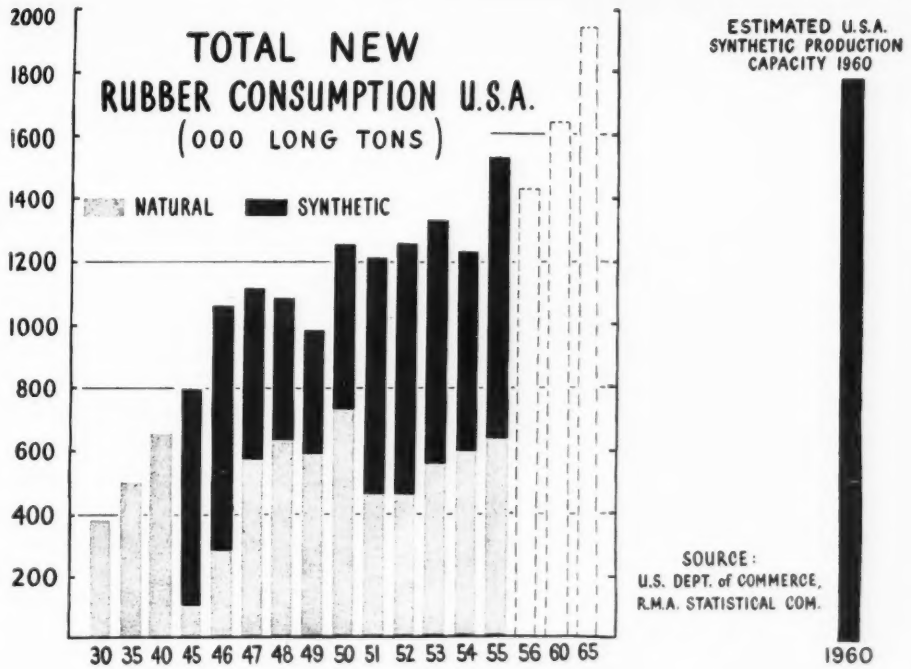
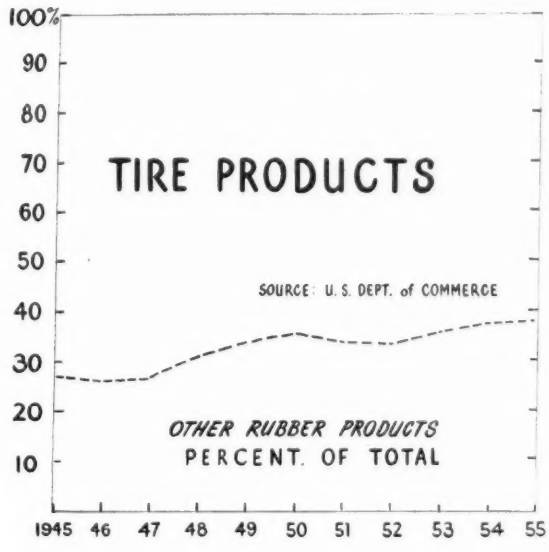


Fig. 3. United States total new rubber consumption, 1930-1955, and estimates for 1956, 1960, and 1965. Estimated U.S.A. synthetic rubber production capacity for 1960

Fig. 4. Proportion of total U.S.A. rubber consumption for tire products and all other, 1945-1955



consumption are shown separately. For the estimated years no separation can be indicated because the relative use of the two main elastomers depends upon unknown price relations and technical advancements that cannot be predicted.

Note that in the past 25 years industry's consumption has steadily increased to a level four times greater than it was at the beginning of this period. The estimate shown here for the next 10 years suggests a further increase of 35%. All of you, I am sure, appreciate there is nothing sacred about estimates. The ones shown here may be wide of the mark, but they do indicate the potential and represent the range of "professional estimators."

While it is only indirectly related to the bars depicting consumption, I have shown one representative of American synthetic rubber production capacity as estimated for January 1, 1960. This estimate is based upon a recent survey made among synthetic rubber producers. It is interesting to note that the potential 1960 capacity exceeds the estimated 1960 consumption for all types of rubbers. There should be no shortage of rubber hydrocarbon by that time, and provided the industry scientists and technicians can tell us how to use more synthetic rubber, we need have little worry about natural rubber supply. I have, however, heard no one predict that we will not need natural rubber by 1960. This increased synthetic production capacity will be used to supply the growing export market that has been referred to.

U.S.A. Consumption by Product Segments

Now that we have reminded ourselves of the growth of our industry as a whole, how about the product segments? Since 1945, rubber consumption has been separately recorded for tire products and for all other rubber products. Figure 4 shows the proportion of the total rubber consumption that went into the manufacture of all rubber products other than tires, tubes, and tire repair materials. This chart demonstrates that over the 10-year span the other-than-tires segment has been growing at a faster rate than tire products, even though twice the number of vehicles are on the roads now than there were 10 years ago; and also in spite of the fact that other materials, such as plastics, have replaced rubber in many non-tire products.

The facts shown here should be of particular interest to most of you who are from non-tire companies. The record shows you have done a fine job in expanding the market for your products, and I expect most of you

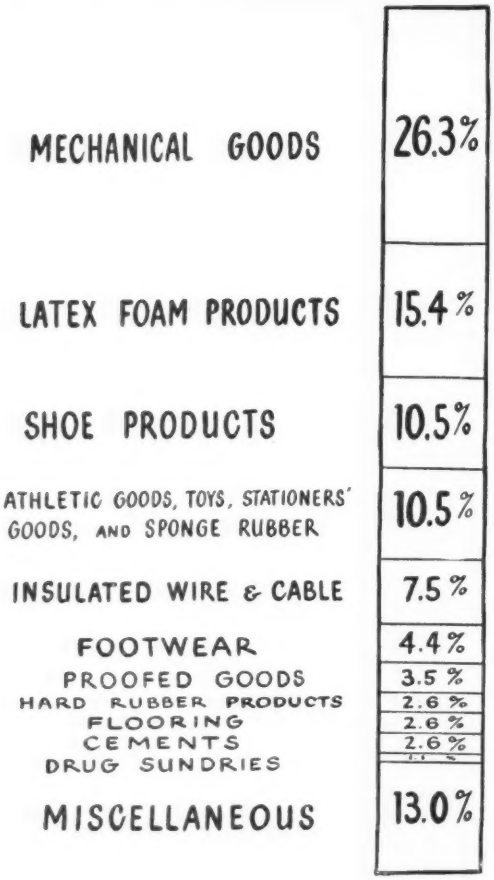


Fig. 5. Estimate of new rubber consumption in USA by product segments other than tire products

look forward to even a bigger slice of the total rubber potential.

Rubber consumption statistics are not collected in any greater product detail than the two main segments just mentioned. There have been estimates made of consumption by product group by certain companies within the industry. Since there are no actual consumption reports, these estimates cannot be verified and therefore often vary one from the other. One such estimate for the year 1955 is shown in Figure 5 for illustrative purposes. It depicts the ratio that each product segment bears to the total amount of rubber used in other than tire products. For example, 26.3% of the non-tire rubber goes into mechanical rubber goods; 15.4% into foam latex products, and other lesser amounts into the other product groups illustrated here.

Sales of Rubber Product Companies

We have discussed the industry's growth possibilities in terms of rubber consumption. Figure 6 shows the industry's past growth as measured in sales dollars. The line graph on this chart shows the dollar sales for rubber product manufacturing companies from 1929 through 1955 as reported in the National Income Series of the United States Department of Commerce. Dollar sales over this period have increased sixfold and show a particularly steep rise in the last five years.

These data are sales by rubber companies, including the sales of all non-rubber products such as chemicals, plastics, metal products, etc., and therefore reflect the diversification of rubber companies into other fields. For the future years this sales line will continue to rise at least in relation to the increase in rubber consumption. It should rise at a faster rate, reflecting even greater diversification and a more profitable operation.

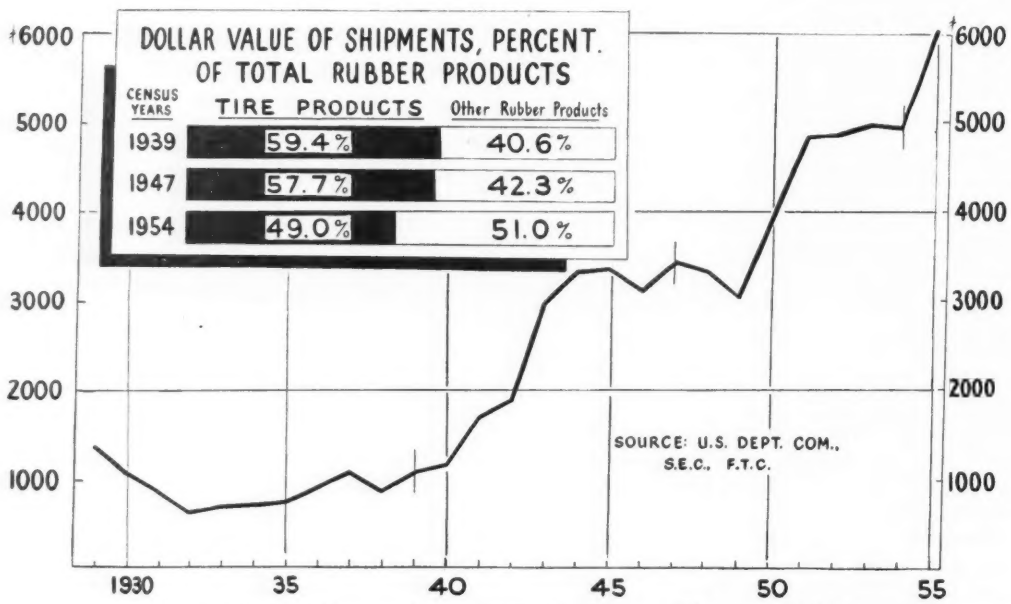


Fig. 6. Sales of rubber product companies in millions of dollars, 1930-1955

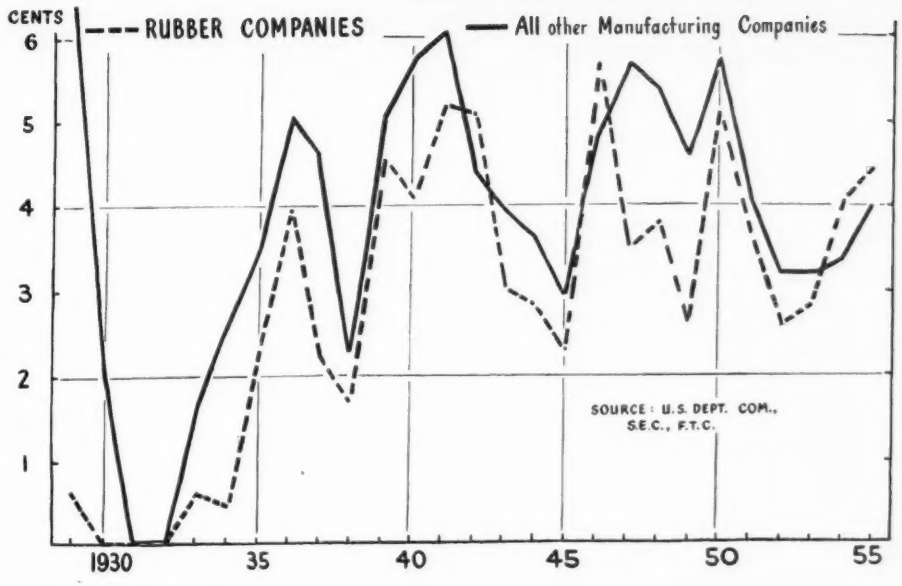


Fig. 7. Corporate income after taxes for rubber companies *vs.* all other manufacturing companies as cents profit per dollar

The bars shown as a part of Figure 6 demonstrate a very significant change in the pattern of industry sales during the past few years. Here we show the proportion of total rubber product sales made by the industry's two main segments—tire products and all other products. These data come from the complete Census of Manufacturers of the Bureau of Census, U. S. Department of Commerce, made in 1939, 1947, and 1954. The comparison has been made on the reported dollar value of shipments of rubber products alone, not including any sales of non-rubber products made by the rubber companies.

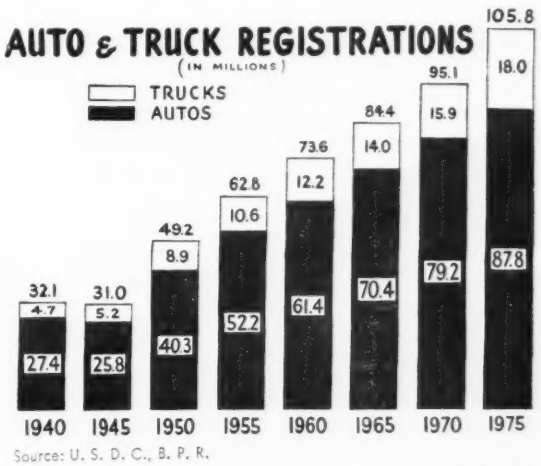
Note that in the first two years reported the sales of all rubber goods other than tire products accounted for 40.6 to 42.3% of the total sales pie. In 1954, however, this figure has grown to 51.0% of the total. During these 15 years the dollar value of sales of non-tire rubber products has increased 500%, while the sales of tire products increased 330%. In terms of growth, the non-tire segment is doing much better in sales than in rubber consumption that was referred to earlier.

Corporate Income After Taxes

We have reviewed the growth trends of our industry in terms of rubber consumption and sales. In Figure 7 we will take a look at the past record of rubber industry profits compared to the profits made by all other manufacturing industries.

Figure 7 reflects the cents profit per dollar of sales after taxes for the period 1929 through 1955. The source for these data is government published reports. The solid line represents the average for all other manufacturing corporations. As is the case with all averages, certain individual industries are above, while others are below, the leveled-out average. The dotted line depicts the reported profits of rubber manufacturing corporations.

For the 27 past years, as reviewed here, we find that



Source: U. S. D. C., B. P. R.

Fig 8. Auto and truck registrations, actual and estimated, 1940-1975

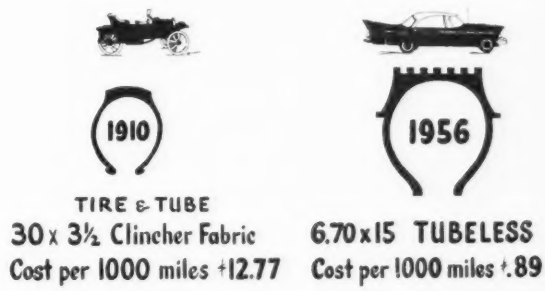


Fig. 9. The tire of yesterday and today

during 21 of those years the average profit on sales of all other manufacturing corporations exceeds the rubber industry profits. During two of the depression years, no profits were shown for any of the industry groups. It has been only in four of these 27 years that

the rubber industry showed sales profits greater than the average. This occurred only in 1942, 1946, and the past two years of 1954 and 1955.

The industry's better comparative position in the past two years may reflect the results of increasing diversification and may also have gotten a healthy assist from the rapid expansion of non-tire rubber product sales, as was previously pointed out.

What the future holds insofar as this comparison is concerned, we cannot hazard a guess.

Auto and Truck Registrations

Underlying our industry's future sales potential is the anticipated growth of the automotive industry, which is our greatest customer. Of the total new rubber consumption, 63% now goes into tire products. It has been estimated that there is as much non-tire rubber in today's automobile as there is in the five new tires. When this non-tire automotive rubber is added to the tire figure, then at least 75% of all rubber used in our industry is required by the automotive industry.

Figure 8 shows auto and truck registration in five year intervals over the past 15 years and projected for the next 20 years. This is a longer projection than indicated on earlier graphs because they were developed in support of the expanded Federal-Aid highway program that became law in June. This new highway program—the largest construction undertaken in the history of man—is designed to handle the vehicle traffic expected in 1975. The Bureau of Public Roads developed this projection in support of highway needs estimated for 1975.

A future vehicle population in the order of these estimates will certainly require large quantities of rubber.

The Tire of Yesterday and Today

Figure 9 is indicative of the tremendous improvements that have been made in the quality and service performance of rubber products. This chart depicts how the customer has been served over the years by ever-increasing values. It shows that the 1910 tire cost the auto owner $12.77 per thousand miles driven; while in 1956 he paid only 89¢ for every thousand miles driven.

At least the same order of quality and service improvement has been built into all other rubber products, but there are no convenient statistics available as in the case of tires where tread wear mileage can be recorded. Rubber belts, hose, footwear, hot water bottles, and even rubber bands, to mention a few, are better in quality and are giving more service per dollar cost to the customer than was the case a few years ago.

Conclusions

New uses for rubber and rubber-like materials are being constantly developed. In the future these new developments will augment the increased demands for current products, adding to the growth potential of the rubber products manufacturing industry.

In order to cash in on these opportunities of apparent growth, this industry must meet and solve many perplexing problems.

NBS Achieves Infrared Spectroscopy of Large Particles

The infrared spectra of relatively large particles has been achieved through a new technique developed by the National Bureau of Standards, United States Bureau of Commerce, Washington, D. C.

The method involves suspending particles in a medium having approximately the same index of refraction as the particles themselves. From the resulting spectrum, changes in molecular structure can be determined. The procedure was worked out for use in a broad program now under way on the degradation mechanism in plastics. Mary Harvey, B. G. Achhammer, and J. E. Stewart, of the NBS staff, are credited with the development of the technique.

Infrared absorption spectroscopy is being extensively utilized as a chemical tool for the analysis of large, complex molecules such as rubbers, plastics, and petroleum constituents. Infrared analysis techniques are also of value in correlating the molecular structure of these materials with their properties.

According to NBS, solid phase spectroscopy has required the particles analyzed to be smaller than the wave length of incident radiant energy in order to minimize scatter. Plastic substances, therefore, are ordinarily studied as thin films, cast from solution or pressed by applied heat. Solvents, however, often remain in the plastics and interfere with their spectra. The heat application is also unsuitable in some cases as it can cause thermal degradation.

Direct attempts to reduce the plastic particles to the established size requirements by grinding or mulling can also result in polymer breakdown. In the NBS method, the desired result, elimination of scatter, is achieved instead by matching the refractive indices of particle and the suspension medium.

The plastic studied by this technique was polyvinyl chloride. Potassium bromide was used as the suspension medium, which exhibits negligible absorption bands in the infrared. Finely ground and carefully dried potassium bromide was mixed with 0.028 g. of polyvinyl chloride in a dry box and loaded into a die, which was evacuated of air. The assembly was subjected to 95,000 psi. for seven minutes, and a clear pellet obtained.

Paper, nylon, and cotton fibers of large size, embedded in pellets of potassium bromide, have also yielded satisfactory spectra, demonstrating the utility of the method, NBS declares.

The Development of Rubber Mountings —Use of Scaled Models[1]

By ROSS E. MORRIS

Mare Island Naval Shipyard, Vallejo, Calif.

The design of a large rubber mounting may be developed by using small-scaled models for experimental work. Equations have been prepared for the ratio of compressive forces to bring about equal unit deformation in large and small mountings, for the same ratio for shear mountings, for complex mountings loaded in compression and shear, and for the ratio of the resonant frequency of the full-size mounting to that of the scaled-down model.

The results of load-deflection and load-resonant frequency tests show that these equations may be applied with confidence to the results of tests on scaled-down mountings to calculate the behavior of corresponding full-size mountings.

THE development of a rubber mounting can be a simple matter of calculation or a time-consuming job of "cut and try," depending on the service requirements for the mounting. Where the problem is to isolate vibration or shock in one or two degrees of freedom, and where uniformity of resonant frequency with changing load is not required, the resilient element of the mounting can have a relatively simple geometric shape.

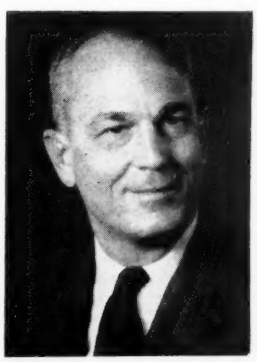
The equations and plotted data of many authors (1-7)[2] and several anonymous publications (8-10) can be used to design the element. Such information is not available, however, for designing the resilient element where the mounting must isolate vibration in the three translational degrees of freedom with essentially equal effectiveness, isolate shock in these degrees of freedom, and provide uniform resonant frequency over a range of loads. In this case it is necessary to make preliminary designs of the resilient element and metal parts of the mounting, and to modify these designs until a mounting with the desired properties is obtained.

A new mold or different inserts for the previous mold must be made every time the shape and the size of the mounting are changed in the course of the development. If a large mounting is being developed, the cost of manufacturing the mold parts and the cost of making the experimental mounting itself will be considerable. Both costs will be less, of course, for a small mounting. The purpose of this paper is to show how a large mounting may be developed by using small scaled models for the experimental work.

[1] The opinions or assertations in this article are those of the author and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

[2] Numbers in parentheses refer to Bibliography items at end of this article.

The Author



Ross E. Morris

Ross E. Morris, since 1939 civilian in charge of the Navy's rubber laboratory, Mare Island Naval Shipyard, Vallejo, Calif., was graduated from California Institute of Technology with a B.S. degree in 1931 and received his M.S. in chemical engineering the following year. Next he held (1932-33) a Fellowship in rubber chemistry sponsored by The Goodyear Tire & Rubber Co. at the University of Akron.

The author then was employed by Goodyear in Akron as a research engineer and compounder (1933-35) and as a compounder at its Los Angeles, Calif., plant (1935-38). He served as chief chemist at Kelly Springfield Tire Co., Cumberland, Md., before assuming his present position.

Mr. Morris, who is a registered professional chemical engineer in the State of California, also is author or co-author of 47 published articles on rubber technology. He is, besides, a member of the American Chemical Society and the Northern California Rubber Group, of which he is a past president. He has been, also, a director of the Division of Rubber Chemistry of ACS.

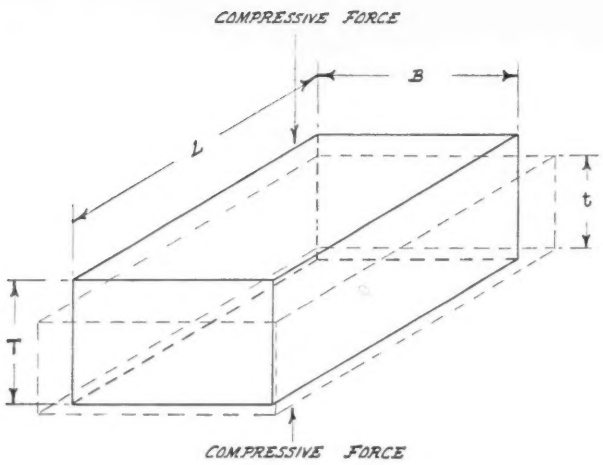


Fig. 1. Sketch of rectangular rubber block in compression

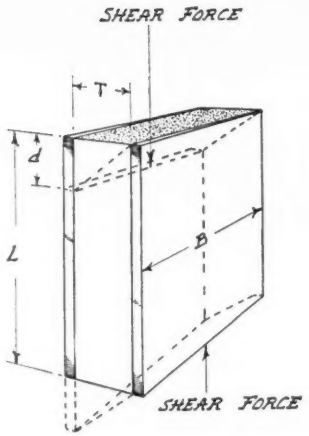


Fig. 2. Sketch of rectangular rubber block in shear

Development of Equations

Compression Mounting

Assume that the mounting were a rectangular rubber block in compression, as shown in Figure 1. The bearing faces of this block are well lubricated; so the ratio of impressed force, F_c, to unit deformation is given by the following equation.

$$\frac{F_c}{\frac{T-t}{T}} = L \times B \times E \qquad (a)$$

where E = Young's modulus, and T, t, L, and B are as in Figure 1.

If all dimensions of this mounting were scaled down by the same factor, a, the above equation would become:

$$\frac{F_{ca}}{\frac{aT-at}{aT}} = aL \times aB \times E \qquad (b)$$

or

$$\frac{F_{ca}}{\frac{T-t}{T}} = a^2 \times L \times B \times E \qquad (c)$$

where F_{ca} = force to produce the same unit deflection as F_c produced in the full-size mounting.

The ratio of F_c to F_{ca} is obtained by solving equations (a) and (c).

$$\frac{F_c}{F_{ca}} = \frac{1}{a^2} \qquad (d)$$

The foregoing equation shows that the ratio of the compressive forces to bring about equal unit deformation in the large and small mountings is equal to the reciprocal of the square of the scaling factor.

Shear Mounting

Again suppose that the mounting were a rectangular rubber block in shear, as shown in Figure 2. The ratio of impressed force to unit deformation of this mounting is given by the following equation:

$$\frac{F_s}{\frac{d}{T}} = L \times B \times G \qquad (e)$$

where G = shear modulus, d = shear deflection, as in Figure 2.

If all of the dimensions of this mounting were scaled down by the same factor, a, the above equation would become:

$$\frac{F_{sa}}{\frac{ad}{aT}} = aL \times aB \times G \qquad (f)$$

The ratio of F_s to F_{sa} is obtained by solving equations (e) and (f).

$$\frac{F_s}{F_{sa}} = \frac{1}{a^2} \qquad (g)$$

As in the case of the compressive forces, the ratio of the shear forces to bring about equal unit deformation in the large and small mountings is equal to the reciprocal of the square of the scaling factor.

Complex Mounting

When a rubber mounting with a resilient element of complex shape is loaded, there may be both shearing forces and conpressive forces in the rubber. The vec-

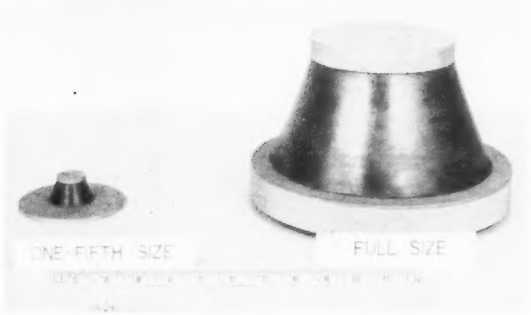


Fig. 3. Mountings A and A-S

torial sum of these forces will equal the load, W, on the mounting.

$$W = \Sigma F_c + \Sigma F_s \qquad (h)$$

It follows, therefore, that when two simple or complex mountings are compared, one of which is the scaled-down replica of the other, their respective loads per unit deformation, W and W_a, will be related by the reciprocal of the square of the scaling factor.

$$\frac{W}{W_a} = \frac{1}{a^2} \qquad (i)$$

Resonant Frequency

The resonant frequencies of the full-size mounting and the scaled-down mounting are given by the following equations when the loads on the respective mountings are related, as shown in equation (i). These equations apply strictly only when the resilient elements have no hysteresis.

$$f = \frac{1}{2\pi}\sqrt{\frac{Kg}{W}} \qquad (j)$$

$$f = \frac{1}{2\pi}\sqrt{\frac{K_a g}{W_a}} \qquad (k)$$

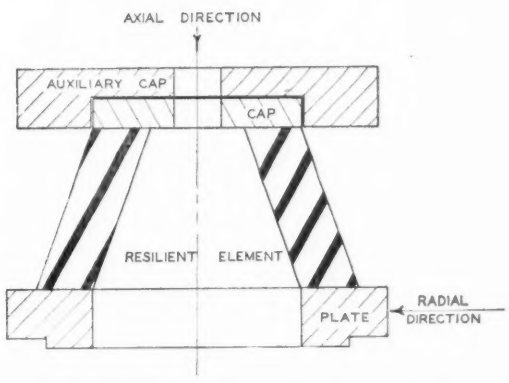


Fig. 4. Sketch of cross-section of mountings A and A-S

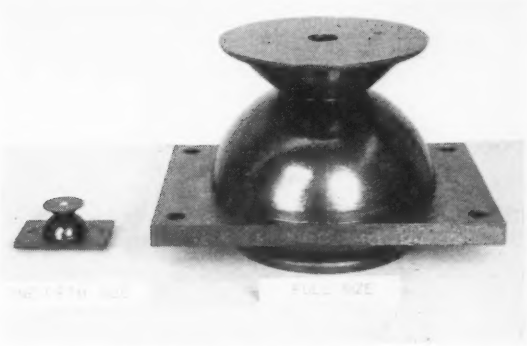


Fig. 5. Mountings B and B-S

where f = resonant frequency of full-size mounting
f_a = resonant frequency of scaled-down mounting
g = acceleration due to gravity
K = spring constant for full-size mounting
K_a = spring constant for scaled-down mounting

In order to solve equations (j) and (k), it is necessary to find a relation between K and K_a. The relation between K and K_a is derived below for a compression mounting (K_c and K_{ca}) and for a shear mounting (K_s and K_{sa}).

By definition:

$$K_c = \frac{F_c}{T-t} = \frac{L \times B \times E}{T} \qquad (l)$$

$$K_{ca} = \frac{F_{ca}}{aT-at} = \frac{aL \times aB \times E}{aT} \qquad (m)$$

Similarly:

$$K_s = \frac{F_s}{d} = \frac{L \times B \times G}{T} \qquad (n)$$

$$K_{sa} = \frac{F_{sa}}{ad} = \frac{aL \times aB \times G}{aT} \qquad (o)$$

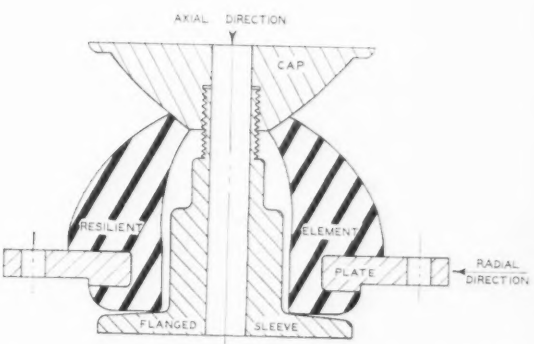


Fig. 6. Sketch of cross-section of mountings B and B-S

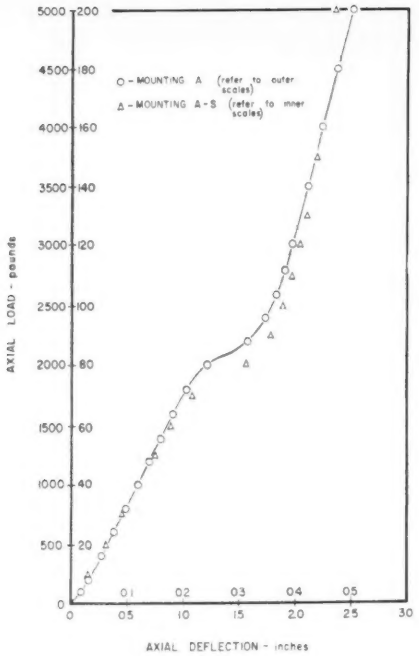


Fig. 7. Load *versus* deflection in axial direction of mountings A and A-S

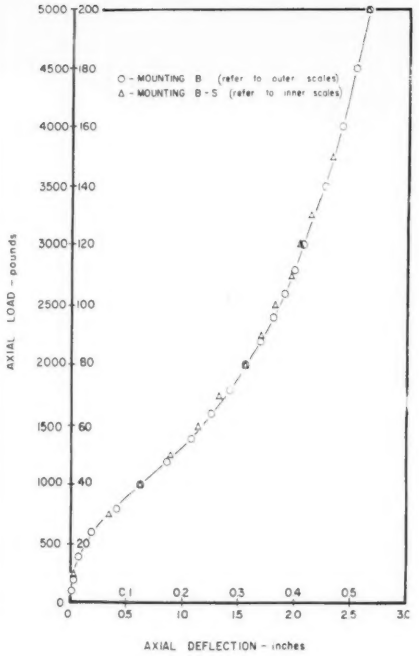


Fig. 8. Load *versus* deflection in axial direction of mountings B and B-S

Solving equations (l) and (m) and equations (n) and (o),

$$K_{ca} = aK_c \qquad (p)$$

$$K_{sa} = aK_s \qquad (q)$$

In accordance with the reasoning applied to equation (h):

$$K_a = aK \qquad (r)$$

Substituting for K_a and W_a in equation (k):

$$f_a = \frac{1}{2\pi}\sqrt{\frac{aKg}{a^2W}} \qquad (s)$$

Solving equations (j) and (s):

$$\frac{f}{f_a} = \sqrt{a} \qquad (t)$$

Thus, the ratio of the resonant frequency of the full-size mounting to that of the scaled-down mounting equals the square root of the scaling factor when the loads on the respective mountings are related as shown in equation (i).

Equations (i) and (t) offer means of computing the probable behavior of a large mounting from the results of tests performed on a scaled-down model. The remainder of this paper will deal with experiments to demonstrate the practical value of these equations.

Confirmation of Equations

Description of Mountings Tested

Four mountings, identified as A, A-S, B, and B-S, were tested for deflection and resonant frequency while supporting various loads. All dimensions of mounting A-S were one-fifth the corresponding dimensions of mounting A, and all dimensions of mounting B-S were one-fifth the corresponding dimensions of mounting B. The four mountings were made from the same natural rubber stock and were brought as closely as possible to the same state of cure in the resilient element.

Photographs of mountings A and A-S are shown in Figure 3, and a sketch of the cross-section of these mountings is given in Figure 4. Photographs of mountings B and B-S are shown in Figure 5, and a sketch of the cross-section of these mountings is given in Figure 6.

The resilient element of mountings A and A-S was a hollow truncated cone; that of mountings B and B-S was bell-shaped. An auxiliary flat cap was used when testing mountings A and A-S, as shown in Figure 4. Mountings B and B-S had a flanged sleeve which served as part of the protection against shock acting in the lateral and upward directions. The flanged sleeve had no effect on the ability of the mounting to isolate vibration when the mounting was loaded in the axial direction.

The shapes of the resilient elements in these mountings were such that loading would cause both compressive and shear strains in the rubber. If equations (i) and (t) were found to be valid for relating the behaviors of

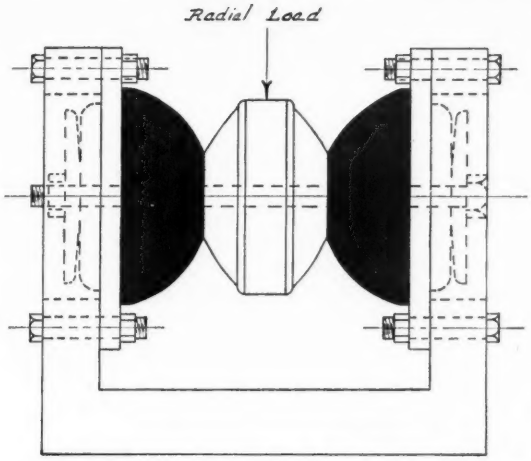


Fig. 9. Sketch of assembly for radial test of mountings

these respective full-size and scaled-down mountings, these equations should also be usable for relating the behavior of any other full-size and scaled-down mountings.

Load-Deflection Testing

The four mountings were tested for load-deflection characteristics in a universal testing machine. The rate of loading was 0.10-inch per minute. The results of the tests made in the axial direction of the mountings are plotted in Figure 7 for mountings A and A-S and in Figure 8 for mountings B and B-S. The abscissa and ordinate of these plots each have two graduations.

Since the scaling factor was one-fifth for both types of mountings, according to equation (i) the load on the small mounting should be one twenty-fifth the load on the corresponding large mounting when the deflection of the small mounting was one-fifth the deflection of the large mounting. Therefore, two graduations differing by a factor of 5 are given on the abscissa to indicate deflection, and two graduations differing by a factor of 25 are given on the ordinate to indicate load. By so doing, the load-deflection curves for the large and small mountings of both the A and B types should coincide if equation (i) is valid. As can be seen in Figures 7 and 8, the agreement between the two curves in each case is very close, thus verifying the validity of equation (i).

Mountings B and B-S were also tested for load-deflection characteristics in the radial direction, using the arrangement shown in Figure 9. Two duplicate mountings were tested at the same time. A constant axial deflection was maintained on the mountings to simulate the result of an axial loading while the mountings were being tested in the radial direction. The axial deflection amounted to 1.53 inches for each B mounting, corresponding to an axial loading of 2,000 pounds, and to 0.306-inch for each B-S mounting, corresponding to an axial loading of 80 pounds. The results of these tests, expressed as load and deflection per single mounting, are plotted in Figure 10.

It will be noted in Figure 10 that the agreement between the radial load-deflection curves of the full-size

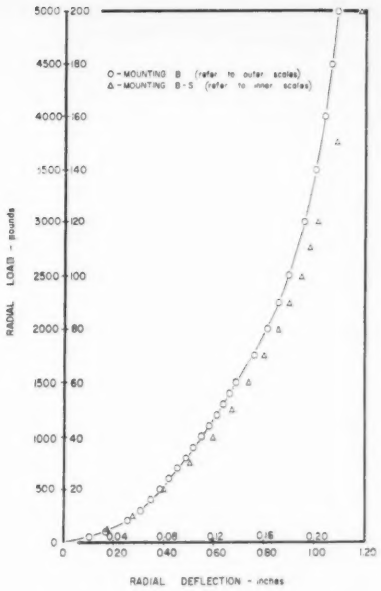


Fig. 10. Load *versus* deflection in radial direction of mountings B and B-S

and scaled-down mountings, while good, was not as close as the results of the axial tests for these mountings plotted in Figure 8. Experimental error in the measurements could have been responsible for the slight disagreement between these curves, because the radial tests were more difficult to perform with precision than the axial tests.

Resonant Frequency Testing

The resonant frequencies of the four mountings were determined in the axial direction while they supported various loads. Resonant frequency is defined as that frequency of harmonic vibration of the mounting where the velocity of vibration reaches a peak value as the force causing the vibration is held constant. All mechanical systems consisting of a spring and a mass have a characteristic resonant frequency. In the case of a mounting supporting a load, the value of the resonant frequency determines the efficiency of the mounting for isolating vibration. Only those frequencies of harmonic vibration can be isolated by a mounting which are greater than $\sqrt{2}$ times the resonant frequency of the system, and the effectiveness of isolation increases as the frequency of the impressed vibration rises above this critical value. Thus, the lower is the resonant frequency of the mounting-load system, the better is the isolation of vibration provided by the mounting.

The load-*versus*-resonant frequency curves for mountings A and A-S are given in Figure 11, and those for mountings B and B-S are given in Figure 12. According to equation (t), when the loads on the full-size and scaled-down mountings stand in the ratio of 5 to 1, the resonant frequencies stand in the ratio of 1 to $\sqrt{5}$, or 0.447 to 1. Two graduations are given, therefore, on the ordinate and on the abscissa of Figures 11 and 12. The ordinate graduations indicating load are in the ratio of

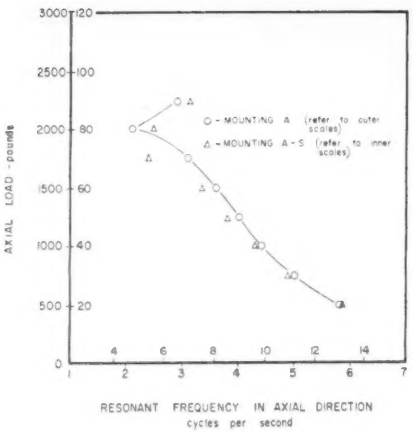

AXIAL LOAD - pounds
RESONANT FREQUENCY IN AXIAL DIRECTION
cycles per second
○ - MOUNTING A (refer to outer scales)
△ - MOUNTING A-S (refer to inner scales)

Fig. 11. Load *versus* resonant frequency in axial direction of mountings A and A-S

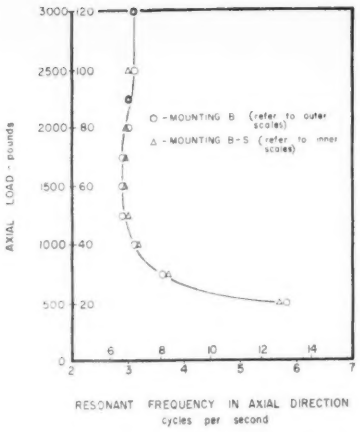

AXIAL LOAD - pounds
RESONANT FREQUENCY IN AXIAL DIRECTION
cycles per second
○ - MOUNTING B (refer to outer scales)
△ - MOUNTING B-S (refer to inner scales)

Fig. 12. Load *versus* resonant frequency in axial direction of mountings B and B-S

5 to 1, and the abscissa graduations indicating resonant frequency are in the ratio of 0.447 to 1 for the full-size and scaled-down mountings, respectively.

Figure 11 shows that good agreement was obtained between the curves for the A and A-S mountings below the respective loads at which the mountings buckled. Mounting A buckled at about 2000 pounds' load, and mounting A-S buckled at about 70 pounds' load. Figure 12 shows that excellent agreement was obtained between the curves for the B and B-S mountings. Incidentally, the constancy of the resonant frequencies of the latter mountings over a wide range of loadings is very remarkable. It is due to the unique shapes of the steel cap and the resilient element, which cause the spring constant of the mounting to increase in proportion to the deflection.

Conclusion

The results of the load-deflection and load-resonant frequency tests prove that equations (i) and (t) may be applied with confidence to the results of tests on scaled-down mountings to calculate the behavior of the corresponding full-size mountings. These equations should simplify the development of large mountings having metal and rubber parts with complicated shapes.

The author wishes to express his gratitude to Robert R. James and Harold L. Snyder for their help in the experimental part of this investigation.

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Simulated Service Tests

One of the difficult problems of the design engineer is that of developing adequate specifications for the purchasing department of his company which will enable it to buy satisfactory products at competitive prices from potential suppliers.

When the volume of business involved is relatively small, the cost of developing an adequate purchasing specification based on laboratory tests becomes prohibitive. A solution to this problem has been outlined in the November, 1956, issue of "Neoprene Notebook," from E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

The solution involves the use of so-called simulated service tests based on the particular service conditions applicable to the product being bought. The device used subjects the product to controlled conditions until recognizable failure occurs. These conditions, however, are adjusted to produce failure sooner than the time required in actual use.

To accelerate the test, the service conditions most conducive to failure are usually changed to intensify their effect. Ambient or induced temperatures, rate and severity of load application, and exposure to deteriorating chemicals are the service conditions most often exaggerated to accelerate failure.

The reliability of the test as a means of evaluating candidate materials can only be established after it demonstrates that it consistently accepts proven products and rejects products found unsatisfactory in actual service.

High-Horsepower Banbury Mixing[1]

By RICHARD N. COMES,
Farrel-Birmingham Co., Inc., Ansonia, Conn.

High-horsepower Banbury mixing has been developed gradually during the last two or more decades through the combined efforts of the machinery manufacturers and the manufacturers of rubber and plastics products. Horsepower input may be increased with the Banbury mixer by varying the sequence of loading the batch ingredients, raising the speed of the rotors, and the use of more pressure on the floating weight.

Examples of increased mixer output obtained by the use of greater-than-normal rotor speeds and floating-weight pressures for certain types of stocks are given. Some of these represent maximum improvement; others may be improved further.

The use of the high-horsepower method of Banbury mixing will provide for shorter mixing times, better quality mixes, or both, for most compounds. Further improvements in machines and methods may provide for even greater advances in output and quality.

IN 1916, Fernley H. Banbury applied for a patent covering a "Machine for Treating Rubber and Other Heavy Plastic Material." This patent was granted in the same year, and Birmingham Iron Foundry, now an integral part of Farrel-Birmingham Co., Inc., was granted the rights to make, use, and vend this invention. This machine was given the inventor's name and called the Banbury[2] mixer.

Upon studying the original patent, one will note that the basic principles described are unchanged in the present-day machine. The methods of using this machine have changed, however, causing great changes in design over and above the original basic design principles, and it is these latter methods of use and design changes that are to be discussed here.

Basically, the Banbury mixer, when examined in its simplest form, is a sturdier, somewhat more complex development of the old sigma or "Z" blade mixer. The blades are strengthened by providing a solid body, but the spiral peripheries are still continued. These rotors are enclosed almost completely in the chamber, with only a narrow opening for feeding the stock to be mixed. Pressure is exerted on the batch by means of a floating weight which closes this feed opening. Discharge difficulties are overcome through the use of a sliding or hinged door at the bottom of the chamber.

The Banbury mixer is used primarily for the breakdown of or incorporation of pigments and fillers into rubber and plastic materials. There are, at the present time, more than 2,000 Banbury mixers in operation.

Since there are more size 11 Banburys in operation than any other size, I will use it as the prime example, although references will be made to sizes 3A and 27 also. The size 11 Banbury mixes a batch that weighs (in pounds) slightly more than 300 x specific gravity of the stock at time of discharge, or approximately a 450-pound batch of an average rubber stock.

Drive Horsepower Increases

The first size 11 Banbury manufactured was equipped with a 200-hp. motor; the rotors revolved at 20 rpm., and the machine had an eight-inch floating-weight cylinder. We have recently shipped a size 11 which was equipped with a 1,500-hp. motor and had provision for rotor speeds up to 60 rpm.

The above-mentioned increase in power and speed was not made all at once, but gradually. Shortly after the first Banbury mixer was made, the horsepower of the motor was increased to 250, and then, with the

[1]Presented before the Rubber & Plastics Division, ASME, New York, N. Y., Nov. 29, 1956.
[2]Trade mark of Farrel-Birmingham Co.

The Author

Richard N. Comes, manager of Banbury mixer sales, Farrel-Birmingham Co., Inc., was graduated from Lehigh University in 1951 with a B.S. in mechanical engineering.

He joined Farrel-Birmingham as a student engineer; became a technical assistant in 1953; and was appointed a sales engineer in 1954 in charge of the New England territory. He was named to his present position in 1955.

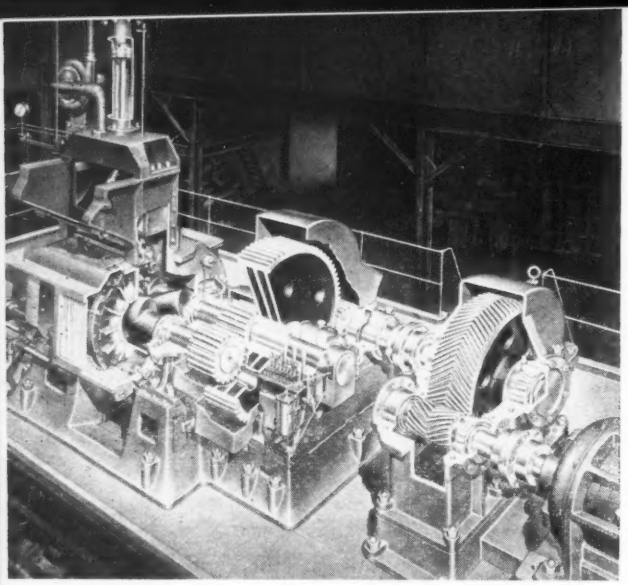


Fig. 1. Cutaway view of size 11 Banbury mixer with standard drive

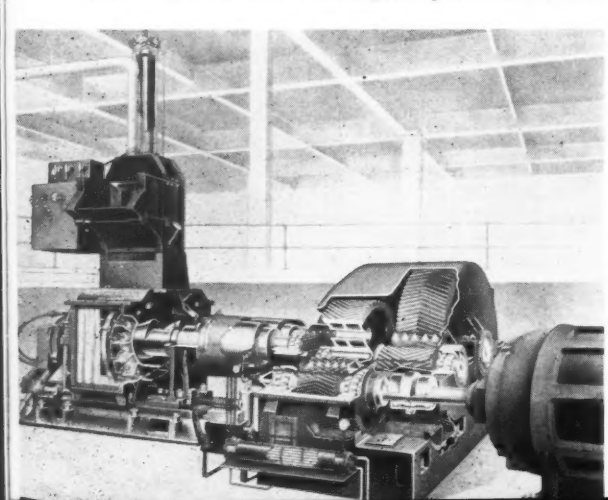
advent of the two-speed Banbury operating at 20 and 40 rpm., the drive required a 250/500-hp. motor. At the beginning of World War II we were asked for, and we provided, a size 11 Banbury for operation at 20 and 40 rpm. with a 300/600-hp. drive. At the time of the military tire program of December, 1944, we received an order for early delivery of 70 size 11 Banburys, about half of which were built for operation at 30 and 40 rpm. with 450/600-hp. motors.

Very soon after the end of the war, we were asked to build a Banbury for operation at 20 and 40 rpm. with a 400/800-hp. drive. Up to this time, only minor changes had to be made to the machine. We felt, however, that the use of this much drive horsepower was going a little too far for standard Banbury construction, and the Uni-Drive[3] was designed.

Figure 1 shows a cutaway view of a conventionally driven size 11 Banbury mixer. Power and motion are transmitted from the motor through a single reduction unit to a drive pinion and gear and then through a pair of connecting gears. As can be seen in this illustration, the bull gear and connecting gears are mounted on the rotors.

The loading of a Banbury rotor is unlike that of a mill or a calender in that the journal does not take a positive

Fig. 2. Cutaway view of size 11 Banbury mixer with Uni-Drive, which removes all gearing from mixer itself



seat, but rotates about the bearing with respect to the position of the wings of the rotors to the chamber and to one another. Also, under heavier loads the rotors will deflect somewhat. These two factors cause some degree of misalinement of the connecting gears and drive gears, eventually causing excessive wear and the necessity of replacement.

For the reasons mentioned above, and also in order to obtain a higher mechanical rating of the gearing on a Banbury, it was necessary to design the Uni-Drive, as shown in Figure 2. In this design we have removed all gearing from the Banbury itself and housed them in their own case on fixed centers, connecting to the rotors through spindles or gear-type couplings. This-type installation minimizes the effects of rotor displacement and also permits better lubrication to the gears and bearings.

Prior to the development of the Uni-Drive, the increase in Banbury-mixer horsepower requirements was due mainly to the increase in toughness of new materials to be processed. Since that time, although new materials still play a large part, the increase in horsepower requirements has been due to the development of new methods of mixing—namely, the so-called high-pressure mixing.

High-Horsepower Mixing

What is high-pressure mixing? Actually, this is a misnomer, since what we are actually interested in is high-horsepower mixing. It is a basic fact that in order to provide a given amount of mixing action on a given elastomeric material, a certain amount of energy in the form of foot-pounds or horsepower-hours is required. If more horsepower can be used, it will take a shorter time to provide the energy to do the same amount of work. In a Banbury mixer, all other factors being the same, there are three methods of increasing the horsepower input—i.e., sequence of loading of the Banbury, speed of the rotors, and pressure exerted by the floating weight on the batch.

We will first treat, briefly, sequence of loading and methods of mixing. In order to obtain a good dispersion of pigments and fillers in rubber, the work must be done in the mass itself. Therefore the amount of work or shearing action required for a given batch, which, in a way, can be considered a measure of the final degree of dispersion of the fillers in the rubber, can be obtained efficiently only when the mix is relatively stiff. The harder a certain pigment is to disperse, the stiffer the mix must be, if a satisfactory dispersion is to be obtained.

Among the several ways used to keep the mix stiff until satisfactory dispersion is obtained are: (1) mixing at as low temperature as possible; (2) adding softeners at the end of the mixing cycle; and (3) removing the batch from the mixer, cooling it, and returning it for further mixing. The latter is readily recognizable as the masterbatch method of mixing.

Increased Rotor Speed

The advantages of increasing the speed of the rotors were recognized many years ago, as is evidenced by the

[3]Farrel-Birmingham Co.

development of the two-speed Banbury. It has been only recently, however, that the possibilities and limitations of higher rotor speeds have been investigated more thoroughly. On many stocks, mixing cycle time can be cut by 30 to 50% by doubling the speed of the rotors. The greatest reduction in cycle time is experienced with softer stocks, such as polyvinyl chloride, polyethylene, and the softer rubber compounds. Although increased rotor speed does have an effect on the stiffer compounds, it does not seem to be so great as on the softer ones.

Increased Weight Pressure

The decrease in mixing time resulting from the use of higher pressures during mixing was more or less a by-product of an experiment we made some time ago in a 3A Banbury mixer in our process laboratory, then located in Derby, Conn. Our 3A Banbury, at that time, was equipped with a 400-hp. motor and a 16-inch-diameter floating-weight cylinder with 200 psi. air pressure available to force the weight against the batch.

A customer had a dispersion problem, and it was decided to try mixing under higher pressures. Not only was the dispersion better, but the mixing time was reduced appreciably. It has been our experience that the application of higher pressure is more effective on stiff stock and that the effect has a point of diminishing return, as indicated in Figure 3.

Figure 3 shows a curve of time cycle *versus* resultant pressure exerted on the batch when 100 psi. air is applied to various-size floating-weight cylinders. It can be seen that, on this particular stock, an appreciable reduction in time cycle is realized when the air cylinder size is increased from eight to 11 inches or even to 16 inches. This reduction in mixing time is less when cylinder size is increased from 16 to 20 inches, however, and a larger cylinder than 20 inches would apparently do little more than increase the cost of the machine. It should be pointed out that the curve in Figure 3 is for data obtained with one particular stock and would take a somewhat different form for another stock, while retaining its hyperbolic characteristics.

Increased Speed and Pressure

Up to this time we have discussed separately the effects of higher speed and higher pressures on Banbury mixing. Since both have at least some effect on all compounds, however, they should be used together, if possible. To what degree each should be used can best be determined by experimentation, although trends can be predicted in advance from the type of stock to be mixed, since it is known that increased speed has the greatest

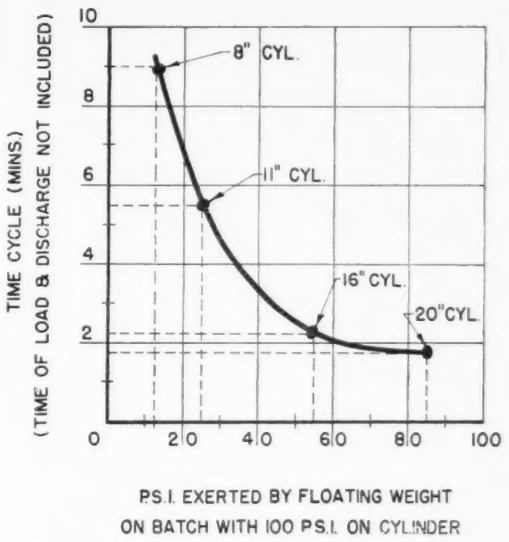


Fig. 3. Mixing time *versus* floating weight pressures for synthetic rubber tread stock in size 11 Banbury mixers

effect on soft materials and increased pressure on stiff materials.

Table 1 shows some examples of the increase in production which high-speed, high-pressure mixing can produce.

The tire stocks shown in Table 1 were run in a size 11 Banbury at normal high speed (40 rpm.) and at pressures more than three times those of normal mixing; the mechanical goods stocks were run in a size 3A Banbury at 100 rpm. (whereas normal high speed is 70 rpm.) and at more than three times' normal pressures; and PVC was run in a size 3A at 100 rpm. and twice normal pressures.

Further tests were run on PVC with increasing pressures, and no appreciable reduction in cycle was realized. The data in Table 1 are presented only to show what has been done. Some results are fairly close to the best that we think can be achieved; others, we feel, may be possible of further improvement.

High-Horsepower Mixing Problems

Up to this point we have presented a favorable story of high-horsepower mixing. As with any change from a standard procedure, it has its problems, however, both for the machinery manufacturer and the rubber processor. Some of these problems have been solved; others are still being worked on.

Table 1. Effect of Increased Speed and Pressures on Mixer Output

Stock	Size Banbury #	Total Cycle* Min.	Rotor Speed	Hp. Av.	Hp. Max.	Norm. Cyc.* Min.	% Inc. Production
SBR tread	11	2.5	40	864	1440	5.5	120
Undertread cushion	11	4.5	40	640	1040	6.5	44
Natural truck tread	11	5.5	40	448	800	7.5	36
Mechanicals	3A	2.3	100	285	402	4.7	104
PVC (plasticized)	3A	2.0	100	260	400	3.25	62

*Figures include time for loading and discharging.

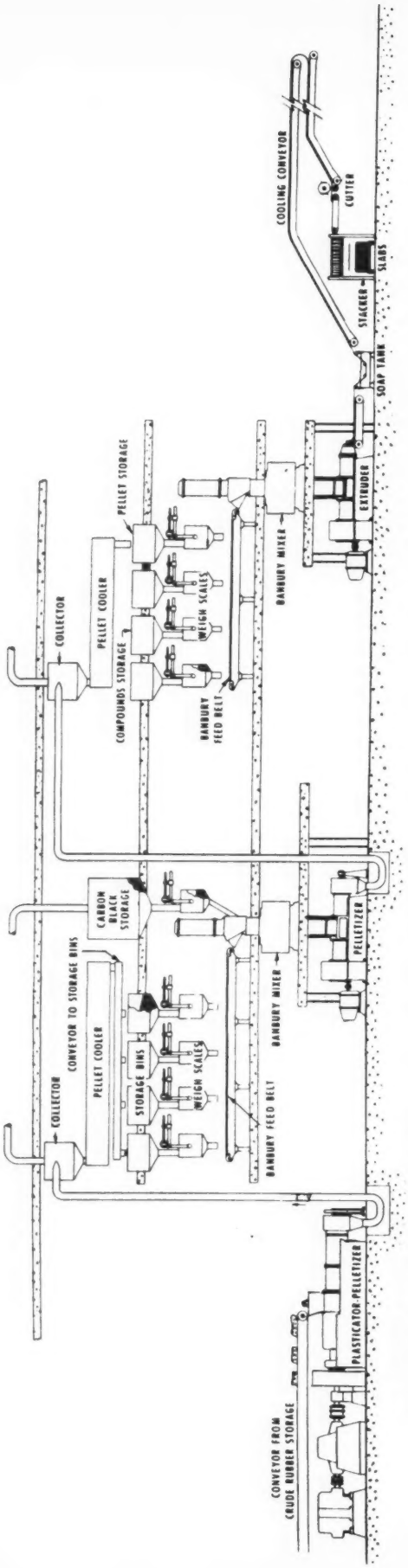


Fig. 4. Rubber pelletizing and slabbing system developed to permit automatic handling of loading and discharge of stock to and from Banbury mixer

Let us first take a look at some of the problems of the machinery manufacturer, since there can be no high-horsepower mixing without a machine that can do this type of mixing successfully and economically. The name itself—high-horsepower mixing—brings to attention the first problem. A machine capable of withstanding heavier loads must be designed, which means heavier end frames, a better drive (in the case of a Banbury, the Uni-Drive), and the redesign of many other components of the machine. The higher pressures used require larger floating-weight cylinders and heavier hopper assemblies to withstand this extra load.

It has been our experience that once the equivalent of 125 psi. on a floating weight cylinder of 11 inches diameter is exceeded, excessive dust-stop maintenance is required. It was, therefore, necessary to design the self-sealing type of dust stop which utilizes the internal pressure of the stock within the Banbury chamber to make a tighter seal, instead of employing external pressure against the internal pressure to provide such a seal.

New Dust Stop

In the conventional type of dust stop, the stock being mixed is prevented from leaking out between the rotor shaft and the body by a bronze faced gland ring sealing against a stellited collar, which collar is shrunk on to the rotor neck. The gland ring is held tightly against the collar by means of three or four springs. The stock which tries to escape from the mixing chamber exerts pressure against the springs, and if this pressure becomes too great, leakage will result. The pressure exerted by the spring must be adjusted carefully, since otherwise excessive wear would result when the Banbury is idling or under light load and the gland rings are tight.

In the case of the self-sealing type of dust stop, a floating ring is free to float axially on the rotor neck, and its stellited face bears against a bronze wear ring which is fixed in the end frame. The floating ring is lightly preloaded against the wear ring, and any material which tries to push its way out only increases the tightness of the seal.

Additional Cooling

Additional cooling becomes very desirable with high-horsepower mixing, since, with the shorter loading, mixing, and discharge times involved, the machine does not have as long to dissipate the heat generated by the mixing action on the material being processed. It became necessary to add more spray nozzles to the mixing chamber wall cooling equipment and to corrugate the back or sprayed surfaces of the mixing chamber. In some cases it is even desirable to use chilled water instead of regular plant water for cooling purposes.

Drop-Type Discharge Door

The time required to discharge the batch, i.e., open discharge door, discharge batch, and close discharge door, became quite important, since it seemed foolish to spend 30 seconds or more to discharge a batch which took only a minute and a half to mix. Thus the drop-type discharge door was developed, which not only is fast

acting, but permits much cleaner operation and should require less maintenance.

The conventional sliding type of discharge door slides horizontally and in a direction parallel to the axes of the rotors, into the bottom of the mixing chamber. In order to achieve a free sliding action, adequate clearances are necessary between the door edges and the grooves in which it slides to allow for thermal expansion and contraction of the metal due to heat generated and lost during mixing operations. With the drop-type of discharge door, the door is hinged, and the surfaces of the door edge and the bottom of the mixing chamber are tapered so that a good line contact can be achieved. As a result, there is less leakage of stock, no "rat-tails" (which are produced by stock rolling up between two sliding surfaces), and therefore reduced contamination of one batch with another, and of even greater importance, essential time is saved as a result of the faster action of the hinged door.

Loading and Stock Handling

As previously stated, high-horsepower mixing presents some problems to the Banbury user also. In order to utilize fully the advantages of this method of mixing, it is necessary for the stock not only to discharge rapidly from the Banbury, but it should be possible also to load it rapidly into the Banbury. Partial or complete automatic loading is desirable and necessary and is being done today effectively and efficiently. Figure 4 is a diagrammatic illustration of such an automatic handling system.

Dry ingredients can be stored in large bins from which they are automatically discharged, weighed, and fed by either gravity or conveyor to the Banbury. These ingredients can be fed into the front, back, or sides of the hopper without opening the hopper door. Oils can be metered and injected directly into the batch in the mixing chamber at any time during the mixing cycle. Rubber can also be automatically weighed or loaded into the Banbury if it has been pelletized or treated in some other manner which will facilitate such handling and loading.

The rubber goods manufacturer also has the problem of what to do with 8,000 to 10,000 pounds of stock being dropped from a size 11 Banbury mixer every hour when he is using high-horsepower mixing. It is possible, but not practical, to handle this volume of stock on a two-roll mill, but some automatic stock handling means becomes extremely desirable. Stock from the Banbury can be handled automatically on a mill, but in many instances, it can be done better by a slab extruder or a pelletizer like those illustrated in Figure 5 and 6, respectively. The slabs or pellets can then be automatically cooled and conveyed to storage or for further processing, as shown in Figure 7.

Summary and Conclusions

It is not our intention to convey the impression that high-horsepower mixing is the answer to all of the rubber or plastics manufacturer's problems. There are many stocks that do not lend themselves to this procedure. Practically all stocks can utilize some part of this method

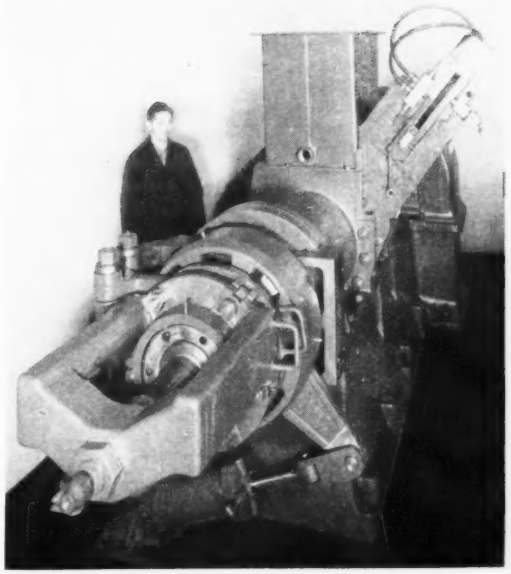


Fig. 5. Slab strainer-extruder for use with size 11 Banbury mixer

to advantage, however, and the results will be shorter mixing times or better mixes, or both. In many cases the masterbatch method of mixing becomes desirable, or even necessary, where very scorchy or difficult-to-mix stocks are concerned. Although this high-horsepower procedure requires additional handling and storage facilities, it will generally pay off with shorter overall mixing time and better quality mixes.

The next question to ask ourselves is, what is the future of high-horsepower mixing, and have we approached the limits of its possibilities? As far as sequence of loading is concerned, there will probably always be revisions in this part of any mixing procedure with the development of new types of compounds. As for the use of higher pressures, we probably have reached the limit on some compounds as we know them today, as is shown by Figure 3. There are other compounds on which little or no work has been done, however, and who knows what sort of materials will be mixed in the Banbury in the future?

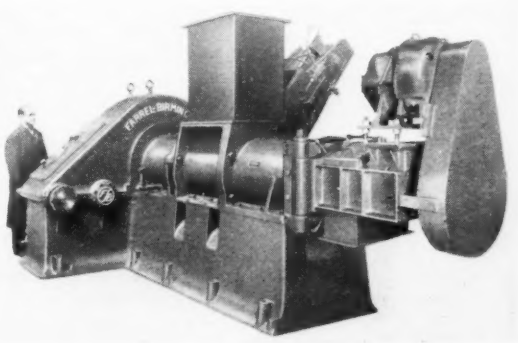


Fig. 6. Twelve-inch pelletizer for use with size 11 Banbury mixer

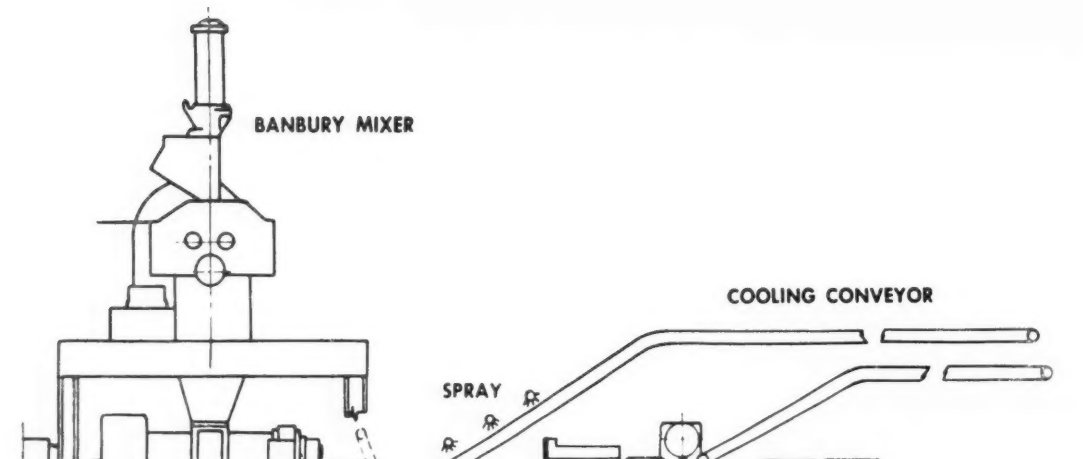


Fig. 7. Simplified system developed for straining, extruding, and automatically handling batches from the Banbury mixers

Speed is a factor which still has to be experimented with much more than in the past. We do know that in the very near future we are going to have to design machines capable of operating at higher speeds and of absorbing greater power input. Take for instance the size 3A Banbury, which has a capacity of approximately one-third the size 11. The first 3A Banburys were equipped with motors rated at less than 100 hp. Standard connected loads on this machine today are 150 and 300 hp., resulting in rotor speeds of 35 and 70 rpm. respectively. We have some 3A's in the field which are equipped with 600-hp. motors, and recent tests in our laboratory on a 3A Banbury indicated that we will design a machine of this size for loads in excess of 1,000 hp., and rotor speeds will exceed 100 rpm.

Next, what can you as a rubber or plastics manufacturer do to utilize the advantages of high-horsepower mixing, and does it involve the purchase of new equipment? In most cases, to utilize fully these advantages, the purchase of new equipment or revision of old equipment is generally required. In many cases the manufacturer is not taking full advantage of the equipment already in his possession, however, and could do so by changing sequence of loading (through experimentation in his own plant or facilities made available to him by the machinery manufacturer); increasing the pressure on the floating-weight cylinder, or increasing the speed of the rotors of his present mixer. The latter two methods should be used with the limitations mentioned before in mind and only after consulting the manufacturer of the mixing equipment.

In concluding, I should like to say that the advances that have been made in Banbury mixing are not results of the efforts of the machinery manufacturers alone or rubber and plastics goods manufacturers alone, but through the combined efforts of both. The machinery manufacturers and the rubber and plastics goods manufacturers have a responsibility to one another to keep each other informed as to new developments in design and procedures. Only in this way can the best possible progress be made in these industries.

Silastic Safety Glass Interlayer

A transparent silicone rubber for the safety glass interlayer of supersonic aircraft windshields has been developed by Dow Corning Corp., Midland, Mich., in conjunction with Wright Air Development Center.

Designated Silastic Type K Interlayer, it is in the uncured stage a soft, plastic, and extremely tacky sheet, calendered between layers of polyethylene-coated Kraft paper. Readily flowable under pressure, type K requires no bonding adhesive. When laminated and cured under pressure in either flat or curved "glazings," it forms a tough, rubber interlayer with very good optical properties, Dow Corning reports. Haze and distortion are minimized, and a high order of transmittance is obtained over the entire spectrum.

Laminated windshields made with Silastic Type K are said to retain full strength and clarity at temperatures ranging from −65 to more than 350° F. Conventional plasticized polyvinyl, butyral used in safety glass interlayers, softens and forms gas bubbles with the rapid losing of shear strength in the intense frictional heat generated by the speed of supersonic aircraft. The polyvinyl butyral also becomes as brittle as glass itself at very low temperatures.

Lamination of Silastic Type K within windshield glass is being done by Libby-Owens-Ford Co., Toledo, O., and Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Meetings and Reports

Properties and Processes Discussed at Rubber & Plastics, ASME, Meeting

The Rubber & Plastics Division of the American Society of Mechanical Engineers held a one-day meeting in New York on November 29 as a part of the annual meeting of the parent Society. The program was devoted to the properties and processing of rubbers and plastics and attracted a good attendance for both the morning and afternoon sessions.

The chairman of the Division for 1956 was R. G. Seaman, RUBBER WORLD, who presided at the luncheon-meeting on the same day of the executive, advisory, and general committees of the Division. At this luncheon-meeting, the chairman reviewed the activities of the Division during 1956 and reported approval by the Society for participation of the Division with the Division of Rubber Chemistry of the American Chemical Society and Committee D-11 on Rubber of the American Society for Testing Materials, in an International Rubber Technology Conference which is scheduled to be held in Washington, D. C., November, 1959.

The Division chairman for 1957, F. J. Wehmer, Minnesota Mining & Mfg. Co., and the Division secretary for 1957, R. W. Barber, St. Regis Paper Co., were introduced.

The technical sessions chairman for this meeting was Prof. James M. Church, Columbia University, and the chairmen and vice chairmen for the two technical sessions are indicated below, together with Professor Church's summary of the papers presented.

Session I

The chairman for the first session was C. Howard Adams, Monsanto Chemical Co., and the vice chairman was Murrey O. Longstreth, Dow Chemical Co. Preprint numbers for seven of the eight papers presented are indicated, and copies may be obtained from ASME headquarters in New York if the titles, authors, and preprint numbers are given.

"The Fundamental Mechanics of Reinforced Plastics," by J. Ogden Outwater, Jr., University of Vermont, was a very interesting theoretical approach to a better understanding of the behavior of reinforced plastic materials. It was suggested in this paper that the governing factors in the behavior of these materials are the pressures exerted on the fibers by the polymerization of the resin, and the coefficient of friction between the fibers and the resin.

This relation was disclosed by a mathematical analysis of the interaction of the fibers and the resin under various conditions. By use of a mathematical model it was possible to evaluate the behavior of the fiber-resin structure under stresses of varying magnitude.

By using the hypothesis which resulted from this analysis it was possible also to predict the stress-strain behavior of the specimen of reinforced plastics. To confirm this hypothesis, previous experimental results were studied in the light of the proposed theory, where real specimens of glass-reinforced plastics were subjected to loading and reloading fatigue stresses.

This paper represents a valuable contribution to our technical knowledge from the standpoint of furnishing a basis for a more practical understanding of plastic materials and a better means of predicting their behavior in actual use. (Preprint No. 56-A-201.)

"Penton—A New Chlorine-Containing Polymer," by E. W. Cronin, Hercules Powder Co., was the second paper on the program. Penton is a chlorine-containing polyether, of a unit structure similar to that of pentaerythritol. The chlorine is attached as a chloromethyl group, which, in turn, is connected to a neo-pentyl carbon, thus making for a chemically stable chlorohydrocarbon. Uniqueness of the polymer lies in its combination of properties rather than in any single property.

Among the outstanding properties cited were the following: (1) high fabrication temperature up to 550° F.; (2) good melt flow resulting in good moldability from low melt viscosity; (3) low mold shrinkage due to highly crystalline structure and low volume changes from liquid to solid, thus permitting close mold tolerances; (4) minimum strains in the molded specimen; (5) high dimensional stability and low water absorption; (6) good chemical and electrical resistance.

On an overall basis, this new polymer appears to be equal or superior to most of the other fluoro- and chlorohydrocarbon polymers.

Suggested uses for the polymer include as a valve material for high chemical and heat resistance, wedges and slot liners for stators in enclosed refrigerator motors, and for ball-bearing retainer rings.

Penton is now undergoing further development studies before any possible commercialization is planned. (Preprint No. 56-A-182.)

"Electrical Effects Accompanying a Stick-Slip Phenomenon of Sliding Metals on Plastics and Lubricated Surfaces," by S. M. Skinner, Case Institute of Technology, J. Gaynor, General Electric Co., and G. W. Sohl, B. F. Goodrich Chemical Co., was concerned with the electrical transient potentials which accompany stick-slip motion in boundary lubrication, resulting from an instantaneous frictional drag in the movement of metallic objects in contact with plastic materials. The characteristics of the electrical discharge created from such a slow-speed friction contact would favor a charge-discharge mechanism rather than a thermoelectrical potential or a dielectric breakdown mechanism.

By use of a frictional apparatus, it was possible to measure both friction and drag, as well as the electrical potentials developed under varying loads at different friction speeds between a number of metals and plastic materials which were partially lubricated by various lubricants.

Conclusions to be drawn from these investigations were summarized as follows: (1) The nature of the electrical discharge is one of a charging mechanism followed by a mechanical breaking away of the charged surface, causing subsequent decay of the plastic material. (2) A change in the measured drag was always accompanied by the presence of electrical transients. (3) Large changes in the measured drag were not accompanied by noticeable changes in the measured vertical load. (Preprint No. 56-A-163.)

"A Review of Developments in Plastics Engineering, 1955-56," by Bryce Maxwell, Princeton University, was the last paper of the first session. It was reported that current plastic production in the United States is about 3.4 billion pounds per year, an increase of nearly one billion pounds since a year ago and representing an increase in growth above that of any previous year. At this growth rate the predicted production in 1960 would amount to more than eight billion pounds, far in excess of consumption based on present per capita plastics use and estimated population based on the present birth rate. A more realistic figure for 1960 plastics production would be seven billion pounds, and this production would have a dollar value of about two billion.

Recent trends due to expansions and mergers occurring within the industry would indicate the possibility of vertical integration of the larger plastic companies for a complete material producing and fabricating type of organization.

Material developments have consisted mainly of new improvements in the older materials rather than the discovery of newer plastic materials. Greatest improvements have occurred in epoxy isocyanate resins, polyesters, nylon, and polyethylene. These improvements have resulted in materials with better thermal stability, flow characteristics of the melt, and greater resistance to aging and warping.

New fabrication techniques have been developed, particularly in the injection and extrusion molding fields. Engineering research studies have added to methods for a better evaluation of plastic materials, such as the tensile impact measurement method for the toughness of plastics.

F. J. Wehmer, 1957 chairman

Analyses of results from heat distortion and melt viscosity measurements have thrown some light on basic resin structure. Continued emphasis is being placed upon fundamental engineering studies of basic problems underlying the application and fabrication of plastic materials. (Preprint No. 56-A-183.)

Session 2

The chairman for the second session was Sherman R. Doner, Manhattan Rubber Division, Raybestos-Manhattan, Inc., and the vice chairman was Prof. William M. Petry, University of Akron.

"Polymer Properties Involved in Process Equipment Design," by H. J. Karam, Dow Chemical Co., was another interesting theoretical paper which demonstrated the usefulness of basic polymer-property data for the practical design of process equipment. Such major polymer properties as strength, thermal stability, and heat transfer were mentioned as being most essential for a correct design of polymer processing equipment. It was pointed out that to obtain sufficiently reliable physical data of polymeric materials, elaborate test equipment or procedures are not required, and much of these data can be acquired from relatively simple test methods.

One cannot stress too much the importance of obtaining and correctly utilizing basic scientific data for good process equipment design, however, rather than relying upon analogy or trial-and-error methods. If the design engineer will realize with which of the material properties he is dealing in the operation of the equipment intended to process these materials, he will be more successful in simplifying and thus solving some of those design problems which prove so troublesome. (Preprint No. 56-A-175.)

"Roll Bending Applied to Rubber and Plastics Calenders," by R. C. Seanor, of Adamson-United Co., was the second paper on the afternoon program. The problem of roll bending or inducing a deflection into a calender roll by applying a bending moment, in order to produce a crown on the roll, has been attempted in various ways in the past without too much success. Devising a roll bender to achieve the desired crown on the roll has therefore made it possible for the purchaser of calender equipment to provide the necessary crown compensation at a minimum cost.

A disadvantage of this method of roll bending is the limited amount of crown compensation which is possible. For calenders already installed, those used for plastic materials can be readily modified by the addition of a roll bender without much alteration of the existing machine. Calenders used with rubber require the installation of new rolls and a relocation of the drive when a roll bending apparatus is added. (Preprint No. 56-A-176.)

"High Horsepower Banbury Mixing," by R. N. Comes, Farrel-Birmingham Co., Inc., is published in full in this issue of RUBBER WORLD, and Professor Church's summary will be omitted in this instance. EDITOR. (Preprint No. 56-A-195.)

"Recent Developments in the Extrusion of Elastomers," by John F. Drew, National Rubber Machinery Co., was the final paper on the program. Continuous mixing and extrusion of elastomers has yet to be achieved. There are certain improvements in extruder design, however, which have increased the probability of such mixing and extrusion being accomplished within the near future. These improvements include the following: (1) a more accurate feeding screw; (2) a better metering of the elastomer to the extruder; (3) the use of extruder liners that will provide for better mixing within the extruder; (4) openings along the barrel to permit the addition of ingredients at the desired location for most efficient mixing; (5) incorporation of a devolatilizer or extractor section for removal of volatile materials from the mix; (6) a more thorough mastication of the mix prior to final extrusion into sheet or pellet form.

N. E. Section, ACS Group, Program on Urethanes

The Elastomer & Plastics Group, Northeastern Section, American Chemical Society, heard Ward J. Remington, E. I. du Pont de Nemours & Co., Inc., on "Urethane Polymers—Their Place in Industry," at a meeting at the Museum of Science, Boston, Mass., on November 20. Chairman John B. Gregory, F. S. Bacon Laboratories, presided at the meeting, at which about 70 members and guests were present.

The speaker first explained that the commercial isocvanates, which vary from high-boiling liquids to high-melting solids, are very versatile in their chemical reactivity. This versatility can be used to advantage in forming a variety of end-products in such industries as rubber, plastics, paints. Typical reactions of diisocyanates with alcohols to form substituted urethanes, with amines to form ureas, with acids to form amides and carbon dioxide, and with water to form amines and carbon dioxide were explained. Rates of reactivity have been determined with various of these materials, and this knowledge can be used to control the products to be prepared.

There are four major fields of application of urethane polymers in which the technology is being worked out. These include adhesives, fluid polymers for spreading and coating applications, solid polymers, and foams. The formulation and technology of foams have probably grown at the fastest rate, and formulations are available for the production of foams varying from dense, rigid to very flexible foams.

Urethane foams, which are usually foamed in place, have several advantages including natural adhesion to almost all surfaces, high structural strength, low density of value in sound and thermal insulation, and the fact that they do not support combustion. Disadvantages include a temperature of service maximum of 300° F., continuing yield or deformation under constant pressure, and tendency to discolor in sunlight.

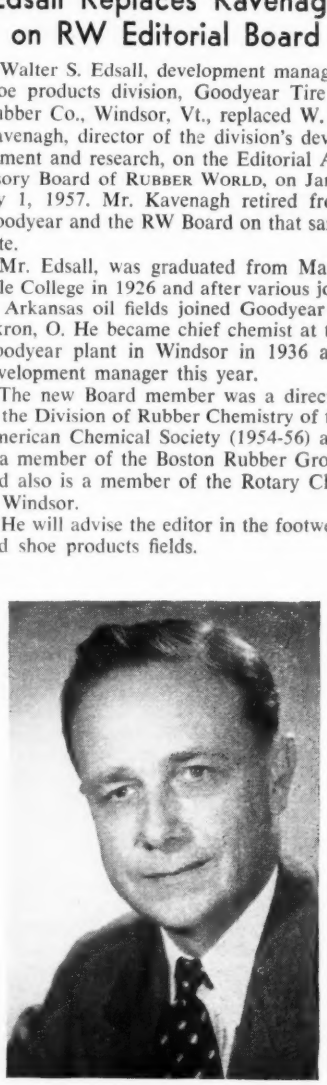
Edsall Replaces Kavenagh on RW Editorial Board

Walter S. Edsall, development manager, shoe products division, Goodyear Tire & Rubber Co., Windsor, Vt., replaced W. E. Kavenagh, director of the division's development and research, on the Editorial Advisory Board of RUBBER WORLD, on January 1, 1957. Mr. Kavenagh retired from Goodyear and the RW Board on that same date.

Mr. Edsall, was graduated from Maryville College in 1926 and after various jobs in Arkansas oil fields joined Goodyear in Akron, O. He became chief chemist at the Goodyear plant in Windsor in 1936 and development manager this year.

The new Board member was a director of the Division of Rubber Chemistry of the American Chemical Society (1954-56) and is a member of the Boston Rubber Group and also is a member of the Rotary Club in Windsor.

He will advise the editor in the footwear and shoe products fields.



Walter S. Edsall

Neoprene and Hypalon Panel Discussion Program at R. I. Rubber Club Meeting

The Rhode Island Rubber Club meeting of November 8 consisted of a panel discussion program on neoprene and Hypalon. F. H. Fritz, E. I. du Pont de Nemours & Co., Inc., discussed "Neoprene—Past, Present, and Future," and answered questions regarding this elastomer, and B. W. Fuller, of the same company, discussed Hypalon 20 and answered questions on the second polymer. The meeting was held at the Pawtucket Country Club, Pawtucket, R. I., and was attended by 250 members and guests.

Senator John O. Pastore of Rhode Island was the after-dinner speaker. He talked on the progress being made in the development of the industrial uses of atomic energy. He mentioned the atomic power plants being built and the care being taken to make sure that waste-disposal methods were adequate to prevent exposure of the population to radiation effects.

New officers and directors of the Club were announced as follows: chairman, Gilbert E. Enser, Collyer Insulated Wire Co.; vice chairman, Kenneth Priestley, United States Rubber Co.; and secretary-treasurer, H. Webster Day, Du Pont. Director for a five-year term will be Joseph Vitale, Crescent Co., Inc.; for four years, Ralph Robitaille, Phillips Chemical Co.; for three years, Edwin Uhlig, U. S. Rubber; for two years, Harry Ebert, Firestone Tire & Rubber Co.; and for one year, Walter Blecharczyk, Davol Rubber Co.

Neoprene—Past, Present and Future

By F. H. Fritz

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

I THOUGHT it might be interesting to review with you neoprene's history and its present status and to see what we believe the future holds for it.

Neoprene was first announced and offered for sale 25 years ago this month. In the entire history of the rubber industry it would have been difficult to have found any period less advantageous for the introduction of a new synthetic rubber. Natural rubber was in plentiful supply and selling at a very depressed price. Although the introductory price for neoprene was $1.05 per pound, this figure was still below its cost of manufacture.

It was apparent that even under normal conditions the cost relation between neoprene and natural rubber would be unfavorable. Thus it was early evident that the acceptance of neoprene depended primarily upon the superior qualities found in its vulcanizates. With this background it is not surprising that the expansion of neoprene sales in the first 10 years of its existence were somewhat less than phenomenal.

During the early Forties, more people learned of the great utility of neoprene and, perhaps even more important, found that products could be manufactured in an economic fashion.

This last-mentioned fact, I believe, is the key to the widely expanding sales of neoprene in the last 10 years. It has been used successfully in almost every type of product normally associated with elastomeric materials—all based on neoprene's ability to do a better job in specific services. Today, rubber manufacturers use quantities of neoprene exceeded only by natural rubber and styrene rubbers in total poundage.

Major Neoprene Uses

To visualize better the extent to which neoprene is used, it might be worthwhile to sketch the present major markets and point out some of the reasons for its adoption. These major neoprene markets are as follows: wire and cable, mechanical goods, automotive, sundries, shoe, tire, and paper products.

WIRE AND CABLE. A great deal of the neoprene manufactured is utilized in protective jackets on various kinds of electrical wire and cable. This penetration results from neoprene's outstanding resistance to deterioration by weathering.

MECHANICAL GOODS. Use in mechanical rubber goods results in a diversity of end-products—such as hose; belting; many types of molded goods including oil field supplies; rolls for the steel, paper, and textile markets; tank linings; and a myriad of others. A growing use for neoprene in the mechanical goods industry involves its application for coal-mine conveyor belts. Neoprene's resistance to burning considerably reduces the safety hazard present in most mines.

AUTOMOTIVE RUBBER PRODUCTS. Substantial tonnages of neoprene are found on today's automobile in products ranging from resilient engine mountings to seals and weatherstrips. Automotive coolant hose, a very competitive item, takes advantage of neoprene's good resistance to heat and ozone as well as to deterioration by a wide variety of coolant solutions. Neoprene combined with improved textile reinforcing members has increased the operational life of V-belts by a substantial margin.

SUNDRIES. Under the sundries classification is included many types of sponge and latex foam, elastic thread for the garment makers, medical supplies, coated and pile fabrics, gloves, and balloons. The coated fabrics industry is a fast-growing one which utilizes neoprene for truck tarpaulins to take advantage of its abrasion and snag resistance among the other desirable qualities. Neoprene finds also increasing application over lightweight fabrics in rainwear.

SHOE PRODUCTS. The shoe industry consumes neoprene in rugged, long-wearing work shoes and as a functional, but decorative sport-shoe component. In this country, but even more extensively abroad, quick-bonding neoprene adhesives are used during shoe assembly operations to provide more than adequate adhesion during rigorous shoe life.

TIRES. Although substantial quantities of neoprene find their way into today's passenger tires its penetration into this vast industry is small—but growing. Neoprene has long been employed as a blend with natural rubber in the fast-expanding white sidewall market. Another interesting outlet involves the circumferential curb strip which takes advantage of neoprene's resistance to weathering, abrasion, and flex cracking in reducing the radial cracking problem.

PAPER PRODUCTS. Paper manufacturers are taking increasing advantage of chemical additives to improve the quality of their products. Neoprene competes favorably with a number of resins as a saturant or better additive to improve the wet strength and other mechanical properties of packaging materials.

The Future of Neoprene

Having briefly indicated something about both the past and present history, let us now turn to the crystal ball and look into the future of neoprene. If I had to limit myself to one word to describe how the Du Pont company feels about the future of neoprene, the word that I would select would be "confident." The present uses for neoprene, as outlined earlier, account for more than 200 million pounds per year. Nevertheless we have just opened a new plant at Montague, Mich., which will increase our capacity by about 25%. From the standpoint of our customers, this means that they are assured of an adequate supply. From our standpoint as members of the Du Pont company it means that we have accepted the challenge of developing new and expanded uses for neoprene.

Our studies have indicated that this increased consumption of neoprene will be derived from at least three different sources: first, the natural growth of the rubber industry; second, expanded uses in existing lines; and, third, the development of markets in new product areas.

According to government sources, the gross national product in the U.S.A. has been increasing at a rate of 3½% per year. The rubber industry as a whole has had a growth rate in recent years of about 4%; while the non-tire segment is expanding at an even faster pace. At the same time constantly increasing technological demands are placed upon rubber products by the consuming public. Neoprene, with its unique balance of properties, is expected to play an important part in these more complex, growing markets.

While demanding higher-quality products, the consumer is also becoming more conscious of the cost of his purchases measured against service life. This situation poses additional burdens on the rubber goods manufacturer, who, already very quality minded, must resharpen his cost pencil. Obviously, reduced raw materials prices—in this case, of neoprene—would bring relief. It doesn't appear, however,

that we will be able to make any price reductions in the near future. We have not increased the price of neoprene for more than three years, during which time our manufacturing costs have increased in the same proportion, I am sure, as have yours. We are very proud that we have "held the line."

Improved Compounding

We believe, however, that we can assist our customers in reducing the cost of neoprene products by compounding and by improved processing techniques. For instance, within the last few years a great number of you have been using highly extended neoprene compounds based upon Neoprene Type WHV which retain many of the advantageous characteristics of neoprene even though the stocks are highly extended with fillers and plasticizers.

Many improvements have been made in the processing safety of neoprene by compounding means. As an example, MBTS in conjunction with NA-22[1] considerably improves the processing safety of Neoprene Type W or WRT with little, if any, sacrifice in vulcanizate quality. In conjunction with raw materials suppliers, safer processing grades of magnesia have been developed and are offered commercially today. Several new types of neoprene have been introduced to facilitate the manufacture of good-quality neoprene products.

A unique, new processing method developed in our laboratories was discussed recently with a few rubber goods manufacturers. It appears possible to reduce manufacturing cost by coating masterbatched pellets with solutions of ultra-accelerators. These coated pellets, when introduced into an extruder, blend the ingredients, and the frictional heat built up during extrusion is sufficient to eliminate or at least minimize the vulcanization time. Many other techniques are under development, which we hope to tell you about in the near future.

Materials Handling

Materials handling and inventory costs have an important bearing on the manufacturer's balance sheet. A palletized unit load system was adopted some time ago as a means of reducing materials handling and, accordingly, cost of using neoprene. Some of the steps involved in this transition have caused all of us headaches—we firmly believe that the "bugs" are now being overcome. To minimize necessary inventory control with certain types of neoprene, cooled storage facilities are being installed at Louisville and our district warehouses. This installation will reduce the variations in plasticity and cure rate associated with the G-types of neoprene due to differences in age and storage temperatures, particularly during the summer months.

Tires

Of the many areas for potential growth in existing product lines are several with more than the usual amount of interest. The past few years have seen a drastic transition in the tire industry. The conversion to tubeless tires, smaller rims, higher speeds, and increased color consciousness

Willard Stewart, Inc.

F. H. Fritz

have all given the engineers sleepless nights. It is gratifying that in many cases neoprene was chosen to satisfy the technological demand. As the requirements become more critical, we believe that larger quantities will be used, in many cases as blends with other elastomers, in sidewalls, curb strips, and in truck tire treads where groove cracking seriously limits tire life. Based on our tests we believe that the liners of tubeless tires should contain neoprene because of its high degree of impermeability, particularly at elevated temperatures. In addition to this increase in quality it will permit the manufacturer to streamline his building technique. By bringing the neoprene liner around the bead, chafing resistance should be measurably improved.

Building Industry

Metal curtain walls are rapidly becoming accepted as standard building materials in the construction of large offices, schools, and hospitals. To fulfill satisfactorily their function, however, as a protective wall the joints between the panels must be sealed to prevent the intrusion of wind and rain. Sealing strips of neoprene have the mechanical attributes necessary to provide this protection. We believe the years of service neoprene has given as wire and cable jackets under extreme weathering conditions can be translated to this type of gasketing. With the forecasted rate of public building in this country the market for gasketing should be a healthy one.

New Products

When speaking of the introduction of elastomeric materials into new product lines I am sure your imagination can easily run rampant. A few examples, such as those I am sure have occurred to you, will serve to illustrate our confidence in neoprene. The automotive engineers tell us that within the next several years we will be riding on cushions of air—air springs. We understand this will be accomplished by containing the air in an elastic envelope which must withstand constant flexing and exposure to the elements. Neoprene with its history of success under similar conditions will be the preferred elastomer for this product.

The engineers in Detroit also believe that functional improvement can be attained by replacing metal fuel lines with flexible tubes or hose. We have been quite interested in this development and have prepared for their evaluation unsupported neoprene tubes capable of carrying today's engine fuels. We trust that they will agree with our confidence in this economical solution to their problem.

Considerable development work has been undertaken in our laboratories to improve the qualities of materials of construction such as concrete, asphalt, and tars. The addition of small amounts of neoprene has indicated that very measurable improvements can be obtained. If field tests and subsequent economic studies prove favorable, a large new market will be born.

Those of you who manufacture latex products may be interested to know that we have several new latices under development which show promise of providing you with a means of producing higher-quality dipped goods and bonded fibers. Although they are not yet ready for commercialization, we are rather excited about their future.

Such "blue sky" dissertations mean little if our customers are not convinced that in neoprene they have an elastomer which means profitable business to them. We solicit your comments and suggestions as to your needs—we will try our best to fulfill them.

Questions and Answers

Q. Please outline the use of colloidal silica gels as reinforcing and thickening agents in adhesive and coatings based on neoprene. What % used? What particle size? How much improvement?

A. There are two classes of materials on which we might base our answer. Wet colloidal silicas such as "Ludox," sold by Du Pont's Grasselli chemicals department, reinforce neoprene latex compositions markedly. When used at a concentration of 5 parts/100 neoprene, the modulus is doubled, and bond strengths are increased about 50%. Higher concentrations reduce stability to an impractical level. Generally one to two parts of monoethylamine are used with the silica to reduce thickening.

Little work has been done in our laboratories with respect to dry silica gels, normally used as desiccants, in neoprene solvent solutions. We expect they would provide increased cohesive strength. However, more economical materials such as hydrated calcium silicate would probably do an equally good job.

Q. On the optical isomerism of neoprene:—Is neoprene predominantly of *cis* or *trans* configuration and to what extent?

A. Neoprene has a predominantly *trans* configuration—probably 95% or over. We would expect to find advantages such as even better high-temperature properties, improved milling behavior, and increased building tack in neoprene polymers of *cis* configuration. Research work to date, how-

[1] E. I. du Pont de Nemours & Co., Inc., elastomers department, Wilmington, Del.

ever, has not produced materials of this type.

Q. What is the effect of fine particle silica on the cold flow and extrudability of both neoprene and Hypalon?

A. I'll answer this question with respect to neoprene and let Mr. Fuller comment on Hypalon. While the fine particle size silicas permit greater versatility in the vulcanizate properties of neoprene, they generally impair resistance to cold flow. Silicas are widely used in connection with other non-black fillers to add body to the extrusions, thereby minimizing distortion prior to and during cure. Silicas are not favored over other materials to produce smooth surfaces.

Recent laboratory work indicated that by the choice of the proper curing system resistance of silica loaded neoprene vulcanizates to permanent distortion under load can be markedly improved. For instance, in Neoprene Type W or WRT stocks containing blends of furnace blacks and silicas, the use of a Thionex,[1] DOTG, and sulfur combination produced safe processing stocks whose vulcanizates had outstanding resistance to water swelling coupled with ASTM D395-55 method B[2] compression set figures of less than 25% after exposure for 22 hours at 185° F.

Q. How does one compound neoprene latex to obtain maximum low-temperature flexibility?

A. The same method is used as with the dry types of neoprene by using conventional low-temperature plasticizers. Processing considerations limit their use to about 20 parts/100 neoprene, which is sufficient for most low-temperature services. Some manufacturers dip thin films containing half of the softener and then post plasticize by soaking the dipped film. The addition of small quantities of styrene rubber latices is helpful in improving low-temperature performance.

Q. What is the best compounding technique and procedure for processing a non-black neoprene calendered sole stock?

A. This subject is discussed in our report BL-312,[1] published in 1956. Generally speaking, fine particle size silicas either alone or in conjunction with clay are the preferred fillers. High styrene resin copolymers are generally employed to produce the desired hardness and feel. Such stocks tend to build up considerable heat during processing and thus should be kept as cool as possible. They usually tend to be dry and boardy. Judicious use of softeners and clay will minimize this condition. It has been our experience that these hard-to-handle compounds mold very well to produce a high-quality sole.

Q. When may we expect a better retarder for neoprene?

A. Generally speaking, we do not favor retarders with neoprene because they impair vulcanizate qualities. We prefer to direct our efforts toward obtaining vulcanizing systems whose activity at processing temperatures is low, but which cure rapidly and tightly at the temperatures normally associated with vulcanization. As mentioned earlier, the newer types of magnesia recommended for neoprene exemplify this trend.

Q. Is anything known about the use of radiation in curing these materials?

A. With respect to neoprene, gamma radiation is effective, but no more so than heat as applied during standard vulcanization operations. As a rule of thumb, we believe that radiation will provide an effective tool for the vulcanization of saturated polymers, but is of little practical moment in unsaturated ones.

Q. How would you compound Neoprene Type WRT-rubber blends to improve heat resistance for an article of a non-black composition used under stress?

A. Currently we would recommend combinations such as the one shown below for the best balance of vulcanizate properties. Quantities shown are parts by weight per hundred of total elastomer in a 50-50 blend.

MBTS	0.25
Thiuram[3]	0.4
NA-22	0.25
Sulfur	0.7

Natural ground calcium carbonate yields slightly better heat resistance than clays, but should be avoided where ozone or exposure to the elements is to be experienced. Hindered phenols will probably provide the best antioxidant protection.

For most services straight neoprene compounds would produce more heat-resistant vulcanizates.

Q. Can epoxy resins be incorporated into Hypalon or neoprene? Assuming an affirmative answer, what method would you recommend, and how are the physical properties altered?

A. Epoxy resins are incompatible with neoprene.

Q. What effects will small amounts of butyl rubber have on the properties of a neoprene compound?

A. Small amounts of butyl added to neoprene act basically as a diluent. They do not measurably improve any vulcanizate properties. On the other end of the scale, however, small amounts of neoprene added to butyl considerably reduce the softening of butyl vulcanizates exposed to high temperatures for long periods of time. This is discussed in our report BL-317.[1]

Q. In colored compounds does Type W Neoprene resist flattening and marking in the uncured state better than Type GN?

A. Yes. Neoprene Type W provides more resistance to distortion and marking by virtue of the fact that it is not plasticized during processing as is Type GN. Neoprene Type WHV can often be added in small quantities to Type GN stocks to provide increased firmness in the uncured state. Marking during open steam vulcanization is often caused by wet steam which condenses on the surface.

Q. What are the latest recommendations for Banbury mixing non-black Neoprene Type W compounds for extrusion?

A. With the small neoprene chips it is generally good practice to add the antioxidant, magnesia, and part of the filler with the neoprene to produce sufficient stock volume for proper massing. The remainder of the filler and the oil are introduced as soon as the batch has come together. The zinc oxide and the accelerator can then be added. Some of our customers feel that a prebreakdown of the neoprene is helpful in producing smooth extrusions. Broadly speaking, judicious choice of fillers will have a more important bearing on surface appearance.

Q. How can you calender smoothly neoprene of fairly high gum content?

A. Experience with neoprene cut-thread compounds of high gum content has shown that the addition of 3-3.5 parts of a low melting grade of polyethylene permits the calendering of very thin smooth sheets. Calender roll temperatures on the top or outside rolls should be about 225° F. and 210° F. on the middle. These temperatures permit the polyethylene to melt and afford release from the rolls.

Small quantities of clay (10 parts) are very helpful in improving the smoothness of calendered sheets.

Q. What are the special cases whereby a neoprene jacketed cable would require greater than 50% by weight of neoprene?

A. The wire industry is using such compounds in mining cable. It is strictly a question of balancing manufacturing costs against the requirements of the specific application.

Q. What storage conditions should consumers of neoprene strive for in their own plant (before mixing and after mixing)?

A. With respect to either raw or compounded neoprene, storage temperatures are probably the most important factors. Low temperatures minimize massing of the raw neoprene in bags and considerably reduce the changes in plasticity and cure rate associated with the G-types of neoprene. Storage temperature has a definite bearing on the stability of mixed neoprene compounds. Speaking very broadly, a reduction in storage temperature of 20° F. would increase the bin life of most neoprene compounds by a factor of two.

Humidity may have an effect on the cure rate of neoprene compounds, particularly those containing hygroscopic fillers.

Q. Specifically, how much resistance to degradation of physical properties, especially permanent set, can be compounded into neoprene and Hypalon stocks for operation at elevated temperatures, i.e., 250-300° F?

A. The W-types of neoprene are preferred when compounding for resistance to high-temperature compression set. The table below illustrates the outstanding resistance to set of Neoprene Type W loaded with a furnace black and accelerated with NA-22. Specimens cured 40 minutes/307° F. were exposed at the temperature indicated and tested in accordance with ASTM D395—Method B.

Temperature (°F.)	% Set
158	8
212	16
250	22
300	33

Recent work has indicated that post-cures in an oven produce definite improve-

[2] American Society for Testing Materials, Philadelphia, Pa.

ment in the compression set characteristics of many types of neoprene vulcanizates.

Longer periods of conditioning under load tend to increase compression set in a linear fashion; the slope of the curve rises with higher temperatures.

Hypalon 20

By B. W. Fuller

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

THIS paper will discuss only briefly what Hypalon is, how it differs from other elastomers, and the basic compound formulations. The principal part of the discussion will cover compounding for certain specific vulcanizate properties and suggestions on factory processing, followed by examples of where Hypalon is used commercially today.

Hypalon is Du Pont's trade name for a synthetic rubber made by chlorosulfonating polyethylene. Although the work leading to the development of this material originated more than 15 years ago, it was not until 1952 that the product was introduced to the rubber industry. The acceptance of the original Hypalon and its successor, Hypalon 20, by the industry has been such that a commercial plant is now under construction. This plant will replace the large-scale pilot plant that has heretofore been supplying the polymer.

General Compounding

There are two major differences between Hypalon and other organic elastomers: (1) the unvulcanized polymer is more thermoplastic than other elastomers so that it heat-softens readily for processing without peptization or preliminary breakdown, and (2) it has a completely saturated chemical structure containing no unsaturated carbon linkages. This chemical saturation results in three important features of Hypalon compounds: (1) vulcanizates exhibit excellent resistance to environments such as ozone, oxygen, heat and oxidizing chemicals that deteriorate other elastomers; (2) antioxidants are unnecessary for all but severe heat applications, permitting the creation of non-discoloring white and colored products with aging properties superior to those of other elastomers; and (3) the curing mechanism differs from that of other elastomers because there are no double-bonds in the molecule to provide cross-linking sites.

Three distinct components must be present in every compound to obtain an optimum state of cure at practical production rates: (1) an organic acid such as hydrogenated wood rosin, wood rosin, or stearic acid; (2) a metallic oxide such as litharge, magnesia or red lead—but not zinc oxide; and (3) an organic accelerator such as MBTS[1] or Tetrone A.[1]

The basic formulations for the great majority of Hypalon compounds are:

	Litharge Cure	Magnesia Cure
Hypalon 20	100	100
Staybelite Resin*	2.5	2.5
Litharge	40	—
Magnesia	—	20
MBTS	0.5	—
Tetrone A	0.75	1

*Hercules Powder Co., Wilmington, Del.

The rest of the compounding is much the same as for any other elastomer with one major exception: no antioxidant is needed except where the vulcanizate is to be exposed to elevated temperatures. Fillers, softeners, extenders, and lubricants function in about the same way in Hypalon as in neoprene. The effects of the various compounding ingredients will therefore not be discussed in general terms, but only as they pertain to compounding suggestions for obtaining certain specific vulcanizate properties.

Compounding for Specific Properties

Shown below is a list of properties important in elastomer vulcanizates which shows what can be obtained with Hypalon by proper compounding:

HYPALON VULCANIZATE PROPERTIES

Tensile strength, psi.	500 to 3500
Elongation, %	250 to 450
Modulus at 100%, psi	300 to 3000
Hardness, Shore A	45 to 95
Compression set (Method B), %	20 to 60
Brittle temperature, °F	−40 to −80
Ozone resistance	complete
Oil resistance	fair to good
Heat resistance	very good
Abrasion and flex resistance	outstanding
Resilience (Yerzley), %	55 to 70
Chemical resistance	very good in oxidizing chemicals
Weather resistance	excellent
Color retention	very good

This discussion on compounding for specific properties will cover some of the more important ones on the list—resistance to ozone, heat, chemicals and weather; compression set; low temperature; and resilience.

Ozone Resistance

No special compounding is needed to obtain complete resistance of Hypalon vulcanizates to ozone. Antioxidants, waxes, or special fillers are not required. Regardless of the stress or the ozone concentration, Hypalon vulcanizates will not fail from ozone attack in service.

Heat Resistance

Another property in which Hypalon excels is heat resistance. When compounded properly, Hypalon vulcanizates give good service up to 350° F. Oven aging tests show that the elongation of Hypalon stocks does not fall to a value below 100% until they have been exposed continuously for eight weeks at 250° F. or for 10 days continuously at 300° F. For best heat resistance, Hypalon should be compounded with 20 parts of litharge plus 10 parts of magnesia—the combination has been found to give better retention of properties than either oxide by itself.

Antioxidants are required for maximum resistance to heat—two parts of Antox[1] for exposure to temperatures up to 250° F., and the same plus one part of NBC[1] for temperatures above 250° F. If a softener is needed for processing or to meet a certain cured hardness value, it should be either a mineral oil of low volatility such as Coray 230,[3] Sundex 53,[4] or Indonex 637½,[5] or a polymeric plasticizer such as Kenflex A or N.[6] Fine precipitated calcium carbonate or soft grades of carbon black are somewhat better than clays or hard blacks for retention of elongation. Acceleration for heat-resistant stocks should include Tetrone A plus MBTS.

Chemical Resistance

In addition to ozone and heat resistance, another benefit derived from Hypalon's saturated chemical structure is its high order of resistance to oxidizing chemicals. Some of the materials Hypalon resists to a greater degree than other elastomers are nitric acid, sulfuric acid, chromic acid (and chrome plating solutions), hydrogen peroxide, pickling baths, and strong bleaching solutions. The most important factor, when compounding Hypalon for chemical resistance, is to select the proper metallic oxide. For the majority of industrial chemical services, involving solutions of acids, bases, or salts, litharge should be used.

For highly concentrated chemicals such as 66° Baumé sulfuric acid or concentrated nitric acid, magnesia cures give better service. The best general-purpose filler for chemical-resistant stocks is blanc fixe or barytes, although for many services carbon black or hard clay is equally satisfactory. An ideal compound for chemical resistance should contain no softener. It is often necessary to include a plasticizer or tackifier, however, to aid in processing the stock or in fabricating the finished product. For such cases, about 10 parts of a polymeric or resinous tackifier may be included in the stock.

Weather Resistance

A fourth property in which Hypalon vulcanizates are outstanding is their stability when exposed to weather. This stability can be obtained with non-black as well as black stocks by proper compounding. The principal factor in compounding for weather resistance is the use of the proper type and amount of pigment, particularly in non-black compounds, so as to screen out or absorb ultra-violet light and thereby minimize its catalytic effect on the oxidation rate. In white stocks, one should use at least 25 parts of titanium dioxide. For colored stocks, there are a number of pigments suitable when used at the three- to six-part level. For black stocks, as little as five parts of any carbon black is an effective screener for ultra-violet light. The fillers that give the best retention of physical properties, color, and surface on outdoor exposure are titanium dioxide and fine precipitated calcium carbonate for non-black stocks, and the finer particle size furnace or channel blacks for black stocks.

As for the curing system to use, litharge is best for blacks and for all but the very light colors in non-blacks. The tendency of litharge stocks to darken on exposure is minimized by using only 25 parts of litharge and by including two parts of cadmium stearate in the compound. Also, non-black litharge stocks should be ac-

[3] Esso Standard Oil Co., New York, N. Y.
[4] Sun Oil Co., Philadelphia, Pa.
[5] Indoil Chemical Co., Chicago, Ill.
[6] Kenrich Corp., Maspeth, N. Y.

celerated with MBT[1] instead of the usual acceleration to prevent formation of black lead sulfide. By following the compounding principles outlined, Hypalon vulcanizates can be made which remain practically unaffected even after three years' continuous exposure in Florida.

Compression Set

The compression set of most Hypalon stocks is about 60 to 75% at 158° F., and as much as 95% at 212° F. This can be reduced considerably, however, by using magnesia as the curing agent plus strong acceleration. Strong acceleration means the addition of a secondary accelerator such as DOTG in addition to the usual Tetrone A,[1] to give a very tight cure. If such a stock should prove too scorchy for factory handling, then use the regular acceleration, but tighten the cure by subjecting the cured product to an oven tempering treatment. The effect of tempering in a 300° F. oven on the compression set at 212° F. is below:

EFFECT OF TEMPERING ON COMPRESSION SET OF HYPALON 20

	Compression Set, % ASTM D395, Method B 70 Hours at 212° F.	Hardness, Shore A
Original: Cured 30 minutes at 307° F.	96	61
Tempered in 300° F. oven:		
8 hours	62	65
16 hours	53	66
24 hours	49	68

The fillers providing the lowest set for a particular hardness level are the thermal carbon blacks. Mineral fillers, particularly clay, should not be used where set is important.

Low-Temperature Properties

There is little or no correlation between the low-temperature brittleness and the low-temperature flexibility of Hypalon compounds. Vulcanizates with a brittle point of –65 to –80° F. can be made quite readily. These same stocks, however, may become quite stiff and lose much of their flexibility below 0° F. To retain flexibility down to –40° F., high amounts of ester plasticizer (i.e., 20-30 parts) should be used, with not over 20 volume % loading of filler.

The resilience of most Hypalon vulcanizates as measured on the Du Pont-Yerzley oscillograph is about 60% at room temperature. In compounding for good resilience and other dynamic properties such as low heat build-up and low stress relaxation, the same principles used for low compression set apply. In other words, use magnesia, and cure as tightly as possible. For applications requiring low resilience or good dampening characteristics, litharge stocks accelerated with MBTS alone should be used, along with clay, whiting, or calcium silicate as the filler. An interesting feature of Hypalon is that its resilience is greatly increased at elevated temperatures —the same compound that has 60% resilience at room temperature may have 85-90% resilience at 212° F.

Processing

The principles that are important in processing Hypalon will now be discussed.

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The suggestions or methods covered are ones being used for Hypalon today in many rubber goods manufacturing plants. They are, therefore, not based merely on laboratory techniques, but have proved practical for factory operations.

It was mentioned earlier that one of the two major differences between Hypalon and other elastomers is its greater thermoplasticity. Although at room temperature Hypalon is stiffer or more viscous than most rubbers, it softens much more rapidly with heat until, at temperatures usually encountered in processing, it is much lower in viscosity than the others. A clear realization of this thermoplastic nature of unvulcanized Hypalon is essential to satisfactory processing and factory handling.

The first processing operation to be discussed is the factory mixing of Hypalon compounds. When placed on a two-roll mill or in a Banbury-type mixer, the fairly stiff polymer quickly develops sufficient heat just from working to heat-soften readily for mixing. No prolonged breakdown is needed. In fact, a full flow of cold water should be maintained in the mixing equipment to avoid excessive heat-softening which may result in poor dispersion of the ingredients in the compound. Thus, the first requisite in mixing Hypalon is to use a cool mixer; remember that after the polymer has been worked for only a very short time it is ready to receive the other compounding ingredients. The steps in mixing a Hypalon compound on a factory mill are shown below:

MILL MIXING OF HYPALON

1. Place the Hypalon on a cold mill set for a ¼-inch sheet. Be sure there is a full flow of cold water through the rolls.
2. As soon as a band forms, add all of the ingredients except the accelerator. These ingredients should be added as rapidly as possible, without waiting for each ingredient to work in before adding the next one. A satisfactory order of addition is:
   a. Litharge and/or magnesia, organic acid, antioxidant (if any), hard blacks, and part of any other filler.
   b. Remainder of filler and softener, added alternately.
3. Maintain a small rolling bank either by opening the mill or by making cutouts from the batch as required.
4. Mix until all ingredients are dispersed thoroughly.
5. Add acceleration, and mix only long enough to disperse well.
6. Cut and blend to obtain good dispersion; batch off rapidly, and cool sheets immediately with water spray or dip.

Stocks can be mill-mixed by this procedure in 25 to 35 minutes. Stock temperatures of 180 to 200° F. are typical.

A schedule for mixing Hypalon compounds in a factory Banbury follows:

1. Use a full flow of cold water on both rotors and shell.
2. Add Hypalon. Ram down. Allow it to soften; about half a minute is generally sufficient.
3. Ram up. Add all other ingredients in rapid succession, including the litharge and/or magnesia and softener. Ram down. Mix until the batch comes together, which will require three minutes or less in most cases.
4. Ram up. Brush down ram and hopper. Add acceleration. Ram down. Mix for one minute or until temperature reaches 240° F. (whichever occurs sooner).
5. Ram up. Dump to batch-off mill set for ⅜-inch sheet.
6. Cut and blend rapidly to obtain good dispersion. Batch off quickly. Cool stock immediately with water spray or dip.

Stocks can be mixed by this procedure in overall cycles of seven minutes or less. It is advisable to dump before temperature reaches 240° F. as experience has shown that batches left in the mixer at temperatures above 240° F. may scorch, particularly in the case of litharge stocks.

The procedures just outlined will work for all stocks containing magnesia as the only metallic oxide and will also work for many stocks containing litharge. Some litharge-containing stocks, however, may be too scorchy to withstand this one-step mixing procedure and still retain enough processing safety to undergo further processing steps such as calendering or extruding. For such stocks it is necessary to keep the litharge separated from the other two parts of the curing system (that is, the organic acid and the accelerator) for as long as possible. This separation can be done only if the litharge is in a form that disperses more readily than the powdered form.

One form in which the litharge can be added is as a masterbatch in Hypalon. A suggested masterbatch is 75 parts of litharge in 25 parts of Hypalon, prepared on a two-roll mill. Another good form in which to add the litharge is as a dispersion in a plasticizer. One such dispersion is a commercial product containing five parts of litharge dispersed in one part of Kenflex N. Using either of these forms, the litharge can be added near the end of the mixing cycle, just before the accelerator is added. Good dispersion will be obtained, while at the same time the total heat history to which the curing system has been subjected will be reduced. Carrying this safety measure one step further, the litharge can be kept away from the rest of the curing system until you are ready to warm up, cal-

ender, or extrude. In other words, mix everything except the litharge and accelerators; store until ready to use; then add the litharge masterbatch or dispersion and the accelerator, either on a mill or in a Banbury-type mixer.

If the mixing principles just described are observed so that the stock or (more accurately) its curing system is subjected to a minimum of heating during mixing, about 90% of the scorching problems encountered during calendering or extruding will be eliminated.

Calendering

The other processing steps to be discussed are calendering, extruding, and molding. Before calendering, the stock must be placed on a warm-up mill for a few minutes to heat-soften it. Only a short warm up is needed because of the stock's thermoplasticity—in fact, to guard against scorch the stock should not be allowed to ride the warm-up mill.

For calendering of sheeting, the smoothness depends upon the amount of loading and the calender roll temperatures. As a general rule, stocks containing more than 30% by volume loading calender smoothly at temperatures of 115 to 130° F. on the center roll, with the top roll 10° hotter to prevent sticking. For softer stocks, or for ones which stick when attempts are made to obtain smoother sheeting by increasing the roll temperatures, very good results can usually be obtained by adding three to six parts of low molecular weight polyethylene to the compound. With polyethylene in the stock, calendering must be done at a center roll temperature of 170 to 190° F.; again the top roll is kept about 10° hotter. At these temperatures the polyethylene functions as a roll release agent so that you get the smoothness and reduced shrinkage advantages of high-temperature calendering without encountering sticking to the rolls. Hot calendering has the added advantage of aiding in ply adhesion when plying up on the calender.

Another operation in which the thermal softening characteristic of unvulcanized Hypalon comes in handy is in the frictioning of fabrics. Friction stocks should contain at least 25 volume % loading and up to 30 parts of tackifier plus softener. Calender temperatures of 150 to 170° F. on the center roll and about 40° hotter on the top roll are recommended.

For skim coating, a stock intermediate in softness between the friction and sheeting stocks should be used. The skim coat should contain at least six parts of low molecular weight polyethylene to give clean release from the center roll at the calender temperatures needed for good tack. The center roll should be 170 to 190° F., and the top roll 10° hotter.

Extrusion

For smoothest extrusion of Hypalon compounds, at least 25 volume % loading of hard clay or fine particle furnace blacks gives best results. For equivalent smoothness with softer blacks or with other mineral fillers, higher loadings are required. It is advisable to keep the softener at a low level—about five to 10 parts. Lubricants are recommended to aid in flow through the tuber with minimum heat build-up. An effective lubricant combination is three parts of petrolatum and two parts of Heliozone.[1] Acceleration should be kept low except where CV curing is desired. For litharge cures, one part of MBTS is suggested for mechanical goods extrusions, and ½ part each of MBTS and Tetrone A for CV cured wire covering. In extruding, first give the stock a brief warm up as for calendering. The extruder should be kept cool for most stocks: barrel temperatures of 100 to a maximum of 150° F. should be used; with a warm head, about 140 to 160° F.; and with a hot die, 190 to 210° F.

Molding

The final factory processing operation to be covered is molding. Hypalon compounds can be compression molded in the same molds used for curing natural rubber, as the mold shrinkage is about the same as or a little less than for rubber. Molding temperatures of 300 to 320° F. are usually used. A typical cure for ASTM slabs is 20 minutes at 307° F. There is little danger of overcuring Hypalon, since tensile strength and elongation are not seriously affected as cure time is extended from 20 minutes to two hours.

The two most common problems encountered in compression molding of Hypalon stocks are pockmarking and tearing. Pockmarking is the one disadvantage resulting from Hypalon's thermoplasticity. It usually occurs only on flat sheets molded from soft or from slow-curing compounds. Such stocks thermally soften at molding temperatures to such an extent that they are not stiff enough to build up the back pressure needed to force all of the air out of the mold. These pockets of trapped air expand when the press is opened and make indentations on the molded surface. The best remedy is to increase the viscosity of the stock or the rate of cure by following one of these suggestions: (1) using faster acceleration, (2) using thoroughly cold stock and closing the mold rapidly to obtain high back pressure before the stock softens excessively, or (3) aging the stock before molding.

The suggestions for minimizing problems due to tearing on removal from the mold are similar to those that apply to other elastomers: (1) reduce curing temperature; (2) use hydrated silica as part or all of the filler or replace part of the filler with mineral rubber to improve resistance to hot tear; (3) use a good mold release such as 1% solution of Aquarex L;[1] (4) change mold design to increase thickness in critical zones, to round-off corners, and to reduce undercuts; and (5) remove piece from mold before fully cured and finish the cure in an oven or vulcanizer.

The thermoplasticity of uncured Hypalon is of value in transfer and injection molding. Hypalon compounds are readily adaptable to these techniques. Typical cure cycles used are three to five minutes at 320 to 330° F.

End-Products

Now that several important principles in the compounding and processing of Hypalon stocks have been covered, it may be of interest to point out some of the commercial products for which these stocks are being used today.

First, in the mechanical goods category some examples are: (1) covers for conveyor belts handling hot materials; (2) acid hose tubes; (3) steam hose covers; (4) rolls; (5) linings for tanks, pipe, valves, and pumps; (6) miscellaneous molded goods such as automotive spark-plug boots, valve diaphragms, O-rings, pump impellers, and gaskets; (7) sheet packing.

In the wire field, two examples of where Hypalon is being used are in aircraft ignition cable and in blends with styrene-butadiene rubber (SBR) to improve ozone resistance.

Hypalon is also found in the tire industry, where it is present as a blend in white sidewalls.

A growing field for Hypalon is in coated fabrics, particularly for outdoor service where color, abrasion resistance, and good weathering are important—for example, in convertible tops and radomes.

Hypalon is also used commercially in high-quality floor tile. At present this tile is going into building lobbies, laboratories, and outdoor installations. It offers the advantages of better gloss, comfort, color retention, and indentation resistance than do other commercial flooring materials.

In conclusion, it is hoped that this discussion has helped to improve everyone's acquaintance with this new elastomer called Hypalon. For those to whom a lot of this was a review of what was already known, it is hoped that some new facts or ideas were obtained which will help in present or future work with Hypalon.

Questions and Answers

Q. Please outline the use of colloidal silica gels as reinforcing and thickening agents in adhesives and coatings based on Hypalon. What % used? What particle size? How much improvement?

A. Materials such as Ludox[1] and Valron[1] have been tried in Hypalon solutions at levels ranging from ½ to 20 parts per 100 of Hypalon. They do not have any effect on the thixotropy of the coatings. They do increase the drying rate and decrease gloss somewhat. It is difficult to get good dispersion as the silica starts settling out after half an hour.

Q. Can Hypalon be furnished in latex form, and is a film formed from this latex resistant to the effects of light and ozone?

A. There is no commercial Hypalon latex.

Q. How can tack be eliminated from Hypalon coatings?

A. One method of minimizing or even eliminating tack is to incorporate from 10 to 30 parts of molding grade polyethylene (such as Alathon 10)[1] into the coating. This material is effective in clear lacquers as well as in pigmented coatings. The higher molecular weight epoxy resins (such as Epon 1001)[7] reduce tack on cured coating surfaces. For pigmented coatings higher loadings of pigment will reduce tack.

Q. What is the effect of fine particle silica on the cold flow and extrudability of Hypalon?

A. The effect of fine particle silica in Hypalon is similar to its effect in neoprene.

[7] Shell Chemical Co., New York, N. Y.

It will produce stocks which are stiffer in the uncured state than stocks containing other fillers. Its disadvantage is that it contributes to scorch and does not give so smooth extrusion as fillers such as clay and FEF carbon black.

Q. What effect does processing heat over a temperature of 190° F. have on vulcanized Hypalon 20?

A. Processing heat above 190° F. does not have any harmful effect on vulcanized Hypalon 20, as long as exposure to temperatures above 190° F. is not for an excessively long period of time. In fact, it is advisable during mixing to let the stock reach temperatures in the 190 to 210° F. range to avoid having excess moisture in the compound, which would reduce processing safety and storage stability. In processing Hypalon, temperatures should not be allowed to go above 240° F., and stocks should not be allowed to ride on warm-up mills for extended periods of time.

Q. How can the scorching characteristics of Hypalon be reduced to make a commercially usable compound?

A. I believe the most important factor in reducing scorch of Hypalon compounds is the use of the proper mixing procedure. As was pointed out earlier, the recommended mixing procedures are designed to keep to a minimum the total amount of heat to which the curing system is exposed during mixing, which is, therefore, one way of reducing scorch. Another point to check where scorch is a problem is the presence of excess moisture in compounding ingredients. A third point is to be sure that the correct acceleration is used. For many applications it may be possible to get by with a slow-acting accelerator such as MBTS. (This has been found to be the case for products such as tank linings, where good bin storage is required.)

Q. Is anything known about the use of radiation in curing these materials?

A. Hypalon has been cured with beta rays from a two-million electron volt Van der Graff generator. A good tight cure, however, has not been obtained by this technique. Tensile strength of uncompounded Hypalon cured by this method runs about 1,200 psi. The elongation will range anywhere from 1,100% for one pass (approximately one-second exposure) to about 150% for 40 passes. These results were obtained on standard ASTM specimens.

Q. Addition of 20 parts of Hypalon to a natural rubber stock to obtain ozone resistance resulted in a considerable decrease in resilience of the compound. Can you recommend any compounding ingredients or methods to increase the resilience of this compound to near what it was before the addition of the Hypalon? Also, what do you recommend for improving resilience of an all-Hypalon compound?

A. The loss of resilience in natural rubber when 20 parts of Hypalon was added was probably due to insufficient cure of the Hypalon portion of the compound. There should be included sufficient organic acid, metallic oxide, and accelerator to vulcanize the Hypalon, in addition to the normal curing ingredients present for the natural rubber.

Suggestions for improving the resilience of an all-Hypalon compound have already been covered.

Q. Can epoxy resins be incorporated into Hypalon? Assuming an affirmative answer, what method would you recommend, and how are the physical properties altered?

A. Most of the work on combining epoxy resins with Hypalon has been done in solution coatings. Epoxy resins are compatible with Hypalon in solution coatings, but the compatibility is limited to about 25 parts in the case of a resin such as Epon 1001. In solid Hypalon compounds we have found that at the five-part level epoxy resin increases mold sticking and appears to have no beneficial effects on physical properties of vulcanizates.

Epoxy resins are used in solution coatings to increase adhesion to substrates, to improve can life, and to give a harder surface having less drag. Such resins do not increase gloss, and they decrease elongation. Small amounts (e.g., five parts) improve the light stability of clear lacquers. In solution, the epoxy resins are usually first dissolved in methyl ethyl ketone and then added to the ball-milled dispersion of the pigments.

Q. How can Hypalon be bonded to metals and nylon?

A. There are a number of commercial cements which give good results on bonding Hypalon to metal. Ones that work well when bonded in a press are: Thixon 0-809[8] primer plus Thixon J-272[8] tie cement; Chemlock 201; Ty-Ply BN;[9] Armstrong N-103 or N-104.[10] For bonding products such as rolls and tank linings, recommendations include using a neoprene tie gum between the Hypalon and the metal, with a standard adhesive system used for neoprene between tie gum and metal. Another system that works well on rolls is to use a semi-hard base made by blending Hypalon with hard rubber. This is adhered to the metal directly with or without a primer; the Hypalon cover stock bonds to this semi-hard base extremely well.

The best method for adhering Hypalon to nylon fabric is to apply to the fabric a solution of Hylene M.[1] If the fabric is not to be used for several days, a cement of Hypalon should be applied over the Hylene M coating to protect it from moisture. An alternative method is to include Hylene M in a Hypalon cement which is then applied to the fabric.

Q. What is the future of Hypalon for wire covering?

A. The future of Hypalon for wire covering is very promising. Its physical properties appear ideally suited for many wire applications. For example: litharge-cured Hypalon is extremely resistant to water absorption. Tests show that after 18 months in 158° F. water, Hypalon picks up less than 60 mg./sq.in. water.

Hypalon also has outstanding resistance to weathering and ozone—after two years' outdoor exposure the physical and electrical properties of Hypalon wire covering are equal to or better than the original properties.

Some of the wire applications for which Hypalon is especially suited are: ignition wire as a jacket or a one-shot insulation plus jacket (it is already being used in aircraft ignition wiring); underground cable, again as a jacket or as one-shot insulation plus jacket—we have found that one-year burial underground has no effect on Hypalon's electrical or physical properties; appliance and fixture wire (including motor lead wire)—where the heat resistance and colorability of Hypalon are big advantages; retractable telephone cord.

Hypalon is not only attractive from a color standpoint, but it also makes a more elastic jacket which recovers more snappily from stretching deformation than does a plastic jacket. As the price of Hypalon decreases with increased commercial production facilities, it is expected that Hypalon will make sizable penetrations into these wire applications.

Q. Specifically, how much resistance to degradation of physical properties, especially permanent set, can be compounded into Hypalon stock for operation at elevated temperatures, i.e., 250-300° F?

A. Where it is desirable to have low set characteristics (whether permanent set or compression set) at elevated temperatures, Hypalon should be compounded with magnesia and with thermal carbon black. This point was discussed previously, where it was pointed out that a very tight cure is necessary. This tight cure can be obtained either by using a strong accelerator or by subjecting vulcanizates to an aftercure.

[8] Dayton Chemical Products Laboratories, West Alexandria, O.
[9] Marbon Chemical, division of Borg-Warner, Gary, Ind.
[10] Armstrong Cork Co., Lancaster, Pa.

A-Energy Tests Conclave

Non-destructive tests developed in the field of nuclear energy will be the subject of a symposium to be held at the Morrison Hotel, Chicago, Ill., April 16-18. The sponsors of the conclave are the American Institute of Chemical Engineers, the American Nuclear Society, the American Society for Testing Materials, and the Society for Non-Destructive Testing.

Recently declassified papers will be presented covering reactor materials, including fuel, sheath or cladding, control, and moderator material; and complete fuel assemblies, among other subjects. Panel discussions are also scheduled. The papers will be published by ASTM after the three-day meeting.

W. J. McGonnagle, Argonne National Laboratory, is chairman of the symposium. Other committee members are W. P. Bigler, Argonne Lab, representing ANS; F. L. LaQue, International Nickel Co., representing ASTM; Stuart McLain, Argonne Lab; H. Migel, Magnaflux Corp., representing SNDT.

Also J. L. Swanson, General Electric Co., representing AICE; S. A. Wenk, Battelle Memorial Institute, representing SNDT; P. D. Johnson, SNDT; and E. A. Wiggin, Atomic Industrial Forum.

Fifth Signal Corps Wire, Cable Symposium Gets Record Attendance; 25 Papers Read

The fifth annual symposium on "Technical Progress in Communication Wires and Cables" was held at the Berkeley-Carteret Hotel, Asbury Park, N. J., December 4-6, under the auspices of the telecommunication division of the Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

More than 800 people representing some 300 industrial, research, and governmental organizations attended the three-day conclave, during which 25 technical papers on wire and cable developments were presented. About 400 people were present at the December 5 banquet. The attendance and representational figures were the highest recorded for the annual event.

Chairmen of the five technical sessions were the following, all of the Signal Corps Engineering Laboratories: H. L. Kitts, chief, outside plant branch; M. Tenzer, chief, microwave and electromechanical branch; W. R. Krueger, chief, line facilities section; H. F. X. Kingsley, chief, wire and cable section; and F. W. Wills, wire and cable section. The opening-day welcoming address was given by Brig. Gen. Earle F. Cook, Commanding General of the SCEL.

Paper Summaries

Summaries of technical papers presented at the symposium of interest to the rubber and plastics industries follow.

"Kel-F[1] 500, a New Fluorocarbon Wire Insulating Material." By J. A. Jupa, M. W. Kellogg Co., chemical manufacturing division, Jersey City, N. J.

The new Kel-F 500 retains the same extreme chemical resistance, low-temperature flexibility, outstanding electrical characteristics, zero moisture absorption, high mechanical and physical properties, and abrasion resistance as the regular Kel-F 270 and 300.

Kel-F 500 offers, in addition, higher continuous heat aging resistance: namely, at temperatures of 150-175° C., greater flexibility, and improved resistance to radiation. Kel-F 500-F is being offered to the wire and cable field for test and evaluation and eventual industrial and military use.

"Properties of Hypalon[2] Wire Coverings." By F. Wayne Keeley, E. I. du Pont de Nemours & Co., Inc., elastomers division, Wilmington, Del.

The electrical, physical, and ozone and corona resistance properties of Hypalon, a chlorosulfonated polyethylene elastomer, under various conditions and after various exposures, were presented. These properties were seen to meet many conditions encountered in wire and cable installations, and the eventual increased use of Hypalon in such installations was anticipated.

"Nylon in Wire and Cable." By A. L. Gibson, Du Pont, polychemical department, Wilmington.

The existing uses of Zytel[2] nylon resin in wire and cable manufacture were examined. Emphasis was placed on the excellent mechanical and chemical properties of Zytel, which make it particularly effective as a jacketing material and, in certain applications, as a primary insulation. The electrical properties, while affected by moisture, still make it suitable for use as a general insulating material at commercial power frequencies.

The new Zytel 37X, though still in the evaluation stage, appears to be the answer to outdoor weatherability. The volume usage of Zytel in wire and cable is increasing rapidly.

"Resistance of Rubber Covered Cable, Jacket, and Insulation Stocks to Weather and Artificial Aging." By J. W. Bryden, F. Rupert, M. Smith, and P. Mitton, Engineer Research & Development Laboratories, Fort Belvoir, Va.

Crabtree and Kemp's ozone chamber provides a more satisfactory piece of equipment for predicting weather resistance of rubber insulation than the weatherometer. SBR compounded with four parts of wax experienced practically no weather cracking, when exposed unstressed for two years, and limited cracking when exposed under stress over the same period of time.

The importance of developing a satisfactory accelerated weathering test which will more accurately predict outdoor suitability of rubber-like materials, and which can be used to compare correctly the merits of different materials, was stressed.

"Aging of Neoprene in a Weatherometer." By G. N. Vacca and C. V. Lundberg, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

It was found that an accelerated ozone test, such as that described by Crabtree and Kemp, in conjunction with a 100° C. air oven test, will give a reliable criterion in a comparatively short time of the expected service life of neoprene wire jackets. The value of a weatherometer in these tests was questioned.

"The Effect of Carbon Black Surface Properties on the Stability of Polyethylene." By John T. Moynihan, Acheson Dispersed Pigments Co., Philadelphia, Pa.

Carbon black has been found to be the most effective stabilizer for polyethylene plastic with respect to degradation due to light and weathering, such as in electrical cable sheathing applications and in plastic pipe. The effect of the carbon black surface on the degree of dispersion, as measured by optical density, was described by means of a semi-empirical relation.

"New Developments in Cable Jacketing Compounds." By D. W. Dahringer and W. T. Higgins, Bakelite Co., Bound Brook, N. J.

The advantages of a new vinyl chloride material, Bakelite Brand NFD-3000, was examined in terms of its suitability for Type IIa, non-migratory cable jackets under MIL-C-17B specification. The compound is a so-called internally plasticized material possessing adequate flexibility without the use of plasticizers or other modifiers. NFD-3000 was shown to offer an ideal solution to the requirements of the specification.

"New Developments in Silicone Rubber Compounds for Extruded Electrical Insulation." By M. G. Noble, General Electric Co., silicone products, Waterford, N. Y.

The reasons for the expanding usage of silicone rubber for extruded electrical insulation were outlined. How developments in new polymers, fillers, vulcanizing agents, and processing techniques were leading to improvements in these silicone compounds was discussed, with fundamental data on physical and electrical properties used as illustration.

"New Developments in Silicone Rubber for Electrical Tapes." By J. S. Hurley, Jr., G-E silicone products department.

The properties that make silicone rubber a useful product for the wire and cable industry were reviewed. The results of a study of GE's SE-100 silicone rubber compounds on ECC-116 glass cloth with the carmelized or 111 finish and on the glass cloth coated as received without any previous heat treatment were presented. Also investigated were the effects of cure time and temperature, as well as catalyst content, on silicone rubber tapes. The equipment used for these tests was described.

"Advantages and Limitations of Insulated Aluminum Wire and Cable." By R. E. Gross, G. A. Snow, and H. R. Stoddard, Simplex Wire & Cable Co., Cambridge, Mass.

Shortages and price fluctuations of copper and lead were said to warrant a wider knowledge of manufacture and utilization of aluminum insulated wire and cable by the producers and users of electrical energy. Aluminum sheathed control cable because of light weight, elimination of conduit, flame resistance, and sheath conductivity should find widespread application in power station requirements.

"C-Rural Wire." By A. P. Jahn, Bell Telephone Labs, Kearny, N. J.

C-Rural Wire is the Bell System code name for a one-pair wire facility consisting of two parallel conductors insulated with polyethylene and intended for aerial use in rural areas. The construction and electrical characteristics of the wire were discussed at length.

"Hi-fax[3] Potentials in the Wire and Cable Industry." By J. B. Martin, W. O. Bracken, and E. W. Cronin, Hercules Powder Co., Wilmington.

Hi-fax is Hercules' linear ethylene polymer. Compared to conventional polyethylene, it is more resistant to heat, harder, stiffer, higher in tensile strength and in density, and somewhat less affected by organic solvents and chemical reagents. Electrically, however, the older polymers are better, particularly in very high frequency applications. But for general power and communication use, Hi-fax was said to show much promise.

[1]M. W. Kellogg Co. trade mark.
[2]E. I. du Pont de Nemours & Co. trade mark.
[3]Hercules Powder Co. trade mark.

"Some Considerations on the Use of High-Density Polyethylene in the Cable Industry." By D. Grant, Imperial Chemical Industries, Ltd., Welwyn Garden City, Herts., England.

The improved mechanical properties, abrasion resistance, and resistance to deformation at high temperatures of the higher density polyethylenes were said to enable cable designers to cut the cost of cables made with them, provided full-scale production of high density polyethylenes reduces their initial cost in the near future.

The tendency of high-density polyethylene to be brittle was singled out as a disadvantage most in evidence under accelerated testing.

"The Effect of Radiation on Polyethylene." By V. L. Lanza, Bell Telephone Labs, Murray Hill.

Judiciously selected irradiation significantly increases the tensile strength of polyethylene with negligible loss in elongation, effects complete crack-resistance, markedly improves the heat distortion of the polymer, and adds to its weathering characteristics. At the same time, only a minor loss in the excellent dielectric properties of the polyethylene takes place. Also, additives are not affected. A dose of 8-16 million reps produces optimum properties.

"The Use of Irrathene[4] Irradiated Polyethylene in Wire and Cable." By Kenneth J. Mackenzie, G-E chemical development department, Pittsfield, Mass.

Among the applications in which Irrathene has been or is being used or evaluated are telephone cable, control cable, hook-up wire, and motor lead cable for submersible-type motors. In addition, applications in coaxial cable, as a protective wrap for sheathed cables, and as a splicing tape for cable joints are under investigation. The use of G-E's three general-purpose grades, three encapsulation grades, one semi-conducting grade, and one extrusion grade of irradiated polyethylene for these purposes was discussed.

"The Extrusion of 'Teflon'[2] 6 Tetrafluoroethylene Resin for Wire Insulation." By D. N. DeYoung and G. R. Snelling, Du Pont polychemicals department, Wilmington.

The die design, guide tip clearance, and oven temperatures were found to be the most critical operating variables on the quality of extruded Teflon wire insulation. For optimum machine performance, the ram displacement rate and the wire speed should be controlled as accurately as possible. Processing difficulties and their remedies were discussed.

"A Practical Approach to the Extrusion of Thermoplastics." By Wallace Hooper, Du Pont polychemicals department.

Recent studies have produced a new understanding of and quantitative expressions for the patterns of flow in an extruder. They have also made it possible to develop a rational, practical system of extruder operation. This system was described. By means of a graph of calculated delivery *versus* pressure at various screw speeds, it was seen that the quick gaging of the efficiency of the extruder's operation and location of the source of any irregularities was possible.

"How to Predict Extruder Performance." By B. H. Maddock, Bakelite.

Fundamental theories of flow in single-screw extruders are based on ideal conditions which almost never exist in practice. There is, therefore, a need of additional information as to the physical condition and effective viscosity of the material in the screw channel. Such information has been developed for polyethylene, and this paper shows how this information can be used to predict extruder performance.

Other Papers

Other papers presented during the symposium were the following:

"High-Speed Color Coding of PVC Insulated Wire." By W. L. Hoff, Western Electric Co., Kearny.

"Subminiature Coaxial Cable R.F. Power Ratings and Connector Characteristics." By G. J. Mares and N. J. Sladek, Amphenol Electronics Corp., Chicago, Ill.

"Aluminum Sheathing Press." By Oscar G. Garner, General Cable Corp., New York, N. Y.

"High-Power, Low-Noise Pulse Cable." By John Agrios, Signal Corps Engineering Laboratory, and Robert G. Feller, Okonite Co., Passaic, N. J.

"Submarine Cable Activities." By Guy V. Williams, U. S. Navy Electronics Laboratory, San Diego, Calif.

"Insulated Parallel Circuit with Air Dielectric for Rural Telephone Service." By W. T. Smith, C. R. Ballard, and R. S. Bailey, Rural Electrification Administration, Washington, D. C.

"A Sealing Connector for Small Insulated Conductors." By E. W. Bollmeier, Minnesota Mining & Mfg. Co., St. Paul.

Symposium Committee

H. L. Kitts and H. F. X. Kingsley, of SCEL, were chairman and co-chairman, respectively, of the Wire and Cable Symposium committee. Other committee members were: R. Blain, Army Signal Communication Engineering Agency, Washington; C. T. Wyman, Bell Telephone Labs, Kearny; B. Jore, Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y.; E. J. Burrough, Du Pont, Wilmington; V. McBride, Plastic Wire & Cable Corp., Jewett City, Conn.; and G. Hamburger, Copperweld Steel Co., Washington.

Rubber Division Montreal Meeting Abstracts March 15

The spring meeting of the Division of Rubber Chemistry, American Chemical Society, is scheduled for Montreal, P.Q., Canada, May 15-17, and is to be a joint meeting with the Rubber Chemistry Division of the Chemical Institute of Canada. The headquarters hotel will be the Sheraton-Mount Royal. Chairman of the local committee on arrangements is O. R. Huggenberger, Dominion Rubber Co. Ltd.

The deadline for submission of abstracts of papers for this meeting is March 15. These abstracts of about 200 words, in quadruplicate, should be forwarded to the secretary of the Rubber Division, ACS, A. M. Neal, E. I. du Pont de Nemours & Co., Inc., Elastomer Chemicals Department, Wilmington, Del. In the letter of transmittal the following information is required: (1) the laboratory in which the work was done; (2) who will deliver the paper; (3) how much time is requested for delivery of the paper. At least one of the authors must be a full member of the American Chemical Society.

Further detailed information regarding this meeting will be published later.

Groups Celebrate Christmas

Buffalo Yuletide Fete

Yuletide was celebrated by the Buffalo Rubber Group with a party at the Trap & Field Club, Buffalo, N. Y., December 5, attended by 206 members and guests. Dinner, entertainment, and the distribution of door prizes comprised the evening's festivities.

John Helwic, Dunlop Tire & Rubber Corp., and Richard Herdlein, Hewitt-Robins, Inc., were elected vice chairman and secretary-treasurer, respectively, during the business session of the meeting. The Group's new chairman is Charles Miserentino, Dunlop, who advanced automatically from vice chairman. Jack Haller, Linde Air Products, and Jack Wilson, Dow Corning Corp., were elected to the executive committee.

The committee in charge of arrangements for the Christmas party consisted of Charles Wahl, Hewitt-Robins; Dan Gubala, Pierce & Stevens; Joe Schutz, Dunlop; and Miserentino and Helwic.

Eight Hundred at Detroit Affair

The Detroit Rubber & Plastics Group held its annual Christmas party at the Sheraton Cadillac Hotel, Detroit, Mich., December 7, with 800 members and guests in attendance. Dinner, entertainment, and the distribution of about 200 door prizes contributed by rubber companies and suppliers constituted the evening's activities.

R. C. Chilton, Permalastics Products, was in charge of the entertainment arrangements. W. A. Wiard, Dow Corning Corp., was chairman of the gift committee.

Officers of the Group for 1957 were announced as follows: chairman, H. F. Jacober, Baldwin Rubber Co.; vice chairman, E. J. Kvet, Jr., Detroit Arsenal; secretary, S. R. Schaffer, United States Rubber Co.; and treasurer, W. F. Miller, Yale Rubber Co.

New York Rubber Group Party

The New York Rubber Group held its annual Christmas party and celebration at the Henry Hudson Hotel, New York, N. Y., December 14, with more than 500 members in attendance for a cocktail party, entertainment program, and prize distribution, made possible by contributions from

(Continued on page 622)

[4]General Electric Co. trade mark.

NEWS of the MONTH

Washington Report and National News Summary

. . . Although Defense Mobilizer Arthur S. Flemming has shelved the Rubber Manufacturers Association plan to increase withdrawals from the natural rubber stockpile, the Association is keeping a tally sheet of rubber arrivals and delays to be sure no industry shortage develops.

. . . The government is not encouraging the construction of additional butadiene capacity. No further rapid tax write-offs for such capacity are likely.

. . . Between now and April 1, public bids on the Government Synthetic Rubber Laboratory and Pilot Plant in Akron, O., will be solicited.

. . . The RMA annual meeting of November 28 provided information on industry growth trends, the extent and the problems of continuing expansion, and the availability and cost of capital funds that would be needed for this expansion.

. . . Year-end statements of the RMA and industry leaders emphasized the outlook for a near-record year in 1957, with a possible $6-billion sales volume. Strong competitive selling and a tough fight to maintain and improve profit margins were included, however, as a part of the outlook.

. . . The civil suit of The B. F. Goodrich Co. against United States Rubber Co. for infringement of its tubeless tire patent was dismissed in U. S. District Court in Baltimore on December 12.

Washington Report

By ROBERT E. L. ADAMSON

Flemming Decision Quiets Stockpile Controversy; Bigger Industry Inventory Suggested by NRB

The rubber industry took a "breather" from controversy during December as the holiday season buried, at least temporarily, the last vestige of disagreement over the need of a federal program to ward off a natural rubber shortage which some interests feel might flow from the long-term closing of the Suez Canal.

RMA Checking Imports

Defense Mobilizer Arthur S. Flemming brought a measure of quiet to the stockpile hassle early in December when he sent a terse, precisely worded letter to General Services Administrator Franklin G. Floete, directing him to shelve a rubber products manufacturers' stockpile proposal until such time that shipping from the Far East delays deliveries to the point that "national rubber shortages are imminent."

He left the door wide open, however, for a renewal of the proposal should it become necessary, and Rubber Manufacturers Association spokesmen have indicated clearly that they are alert and ready to sound the shortage alarm. It may be sounded at a meeting this month of the government's Rubber Industry Advisory Committee and Mr. Floete's rubber aides in the Defense Materials Service—E. H. Weaver and George Casto. But whether it comes this month or later, there is little doubt in most quarters here that the issue will be reopened before the Suez Canal is. Meanwhile the plan's sponsor—RMA—has already begun to keep a tally sheet of rubber arrivals and delays, if they develop, as statistical ammunition for another appeal for federal cooperation to prevent a drastic market tightening.

The plan, a simple one, would have the stockpile managers at GSA authorize postponements for those purchasers of stockpile rubber who cannot meet their commitments to replace their purchases within the 60-day redelivery period. With a little leeway of this nature, the manufacturers have suggested buyers of rubber being rotated from the stockpile into commercial use will tend to purchase more than the regular 7,500 tons a month from the stockpile if a shortage threatens. Between these increased purchases and longer redelivery periods, they add, a dangerous price upswing may be precluded.

Flemming Decision

Dr. Flemming had this to say about the feasibility of starting such a program now:

"The Defense Materials Service (of GSA) has informed us that it has received the conflicting advice from its Rubber Business Advisory Committee as to the need at this time for governmental action in regard to changes in our rubber stockpile rotation policies and procedures." [The committee—nine each rubber manufacturers and importers—split evenly over the RMA plan.]

"As I understand it, the Departments of State, Commerce, Defense and the Defense Materials Service have all advised that the present situation does not warrant any permanent change in the government's policies and procedures. I concur in this advice.

"I do feel, however, that it would be wise for the government to state that if shipping is delayed to such an extent that national rubber shortages are imminent, the government will be prepared to consider, at the time such shipping shortages appear, temporary postponement of rubber stockpile deliveries."

NRB Comments

Natural Rubber Bureau President H. C. Bugbee, neutral during the debate leading up to the Flemming pronouncement, quickly issued a strong endorsement of his decision. He called the question presented to the Defense Mobilizer one of "fundamental interest" to the producers, as well as importers and rubber product manufacturers. Dr. Flemming's letter, he said, was awaited in Malaya and Indonesia "more intently than has any other governmental decision on rubber" since that to create a private synthetic rubber industry by selling the government's vast production facilities.

"At stake was this," he declared. "If the huge United States stockpile [estimated at 1.2 million tons] can be considered a reservoir to be tapped by administrative action —in the absence of a verdict by the President that a state of national emergency exists—whenever pipe lines become shortened, then a precedent would be established which would indicate that the government is willing to provide the source of a stock cushion which industry itself has carried in the past. This clearly is not the intent of the stockpiling authorities, and GSA, which administers the rubber stockpile, has tried from the start to make certain that it did not adopt procedures which could unduly influence normal market operations. The State Department has been zealous in insuring that producing countries could have no legitimate complaint that the stockpile was being used as a price brake or a price weapon.

"In the current instance, it is true that the Suez Canal will probably remain blocked for months, but it is equally true that the average increase in shipping time to the East Coast around the Cape of Good Hope should be less than a week, and a smooth procedure of rerouting ships around the Cape had in fact started in some cases before the Canal was actually blocked and is now generally adopted. Shipments via the Pacific to the West Coast are, of course, unaffected, and increased shipments undoubtedly will be made through the Panama Canal.

"To take the occasion to delay replacements for an indefinite period by from 30 to 60 days would seem to be unwarranted by a shipping delay of perhaps a week, and we would doubt whether such action would command favor with the government agencies other than the State Department and GSA, both of which would, we assume, oppose it on grounds of international policy.

"No shortage of natural rubber exists, or seems likely to exist," the natural rubber spokesman asserted. "If the situation in the East worsens to the point where the President declares a national emergency, instant action can be taken on national security grounds to relieve the emergency. In the meantime, the kind of cold war emergency facing us in the Middle East seems likely to be with us for many years, and a higher non-government-owned natural rubber stock position would provide a more comfortable cushion for 'normal' rather than 'national' emergencies.

"In vital instances of this kind in the past, the government agency concerned with rubber [ODM] has taken due note of the international impact of its move, and in our judgment they have done so in this instance."

No Rapid Tax Write-Offs for Butadiene Likely

There was growing evidence in December that the Eisenhower Administration will not reopen or revise upward the rapid tax write-off program for plants capable of producing butadiene. Sources at the Office of Defense Mobilization, the final authority on any government action to boost capacity for any strategic commodity, said official sentiment was now strong against government interference in the normal play of supply and demand among the "cousins" butadiene, butylene, butane, and alkylates.

Under its defense mobilization authority, ODM has the power to authorize rapid amortization, for tax purposes, of any production facility important to the national security. If ODM finds this country short of production capacity for any strategic commodity, it may authorize industry to amortize some portion of the investment in such capacity over a period of five years instead of the normal 20 years for an industrial facility. This system of incentives has swelled production ability in some industries of mobilization significance well beyond what it would be in a straight commercial economy.

No Butadiene Study Made

The production goal for butadiene was suspended a year ago, with some firms still knocking on the door with offers to build new capacity with the aid of rapid tax write-offs. Before ODM could formally close the goal, the military rushed in with a warning that further study was necessary in view of the trend toward higher compression engines for commercial and military vehicles. High-compression engines use high-octane gasolines, and the latter use greater quantities of petroleum alkylate which, along with butadiene, can be manufactured from refinery butylenes. An upsurge in the demand for alkylate, the military reasoned, could bring a shortage of butadiene and a consequent tightening of the synthetic rubber supply.

Heeding the Pentagon's warning, Defense Mobilizer Arthur S. Flemming dropped the problem into the lap of the Interior Department's Hugh A. Stewart, chief of the Division of Oil and Gas and the key figure in the oil lift to western Europe.

Stewart told RUBBER WORLD just before the Christmas holidays that he has been much too busy since Egypt seized the Suez Canal and its subsequent blockade to take a serious look at butadiene. Furthermore, he predicted it would be some months before he could schedule it for detailed study. Thus he was in no position to render a judgment on whether the tax amortization goal for butadiene should be reopened to encourage further construction.

No Rapid Tax Write-Offs

At ODM, however, where interested officials not working on the oil problem have kept in close touch with the situation, it was pointed out that the Administration's policy on the tax write-off program has changed considerably in the past year, and there is little disposition to revive the butadiene goal, regardless of what the restudy by Stewart shows.

Furthermore, these ODM sources hinted that the Pentagon had swung around to the realization that the new civilian demand for alkylate-laden, high-octane gasolines was providing sufficient incentives for private industry to make the necessary investments in basic production facilities. Without this demand, it was noted, the government might have to take a hand to insure adequate supplies for a national emergency; with it, there is insufficient pressure to take what the Administration has increasingly come to regard as unwarranted interference in a free economy.

At any rate, it will take a strong demand from the Pentagon to reinstitute a program of government aid in this area. Even then, the military's needs must be reviewed by Interior's Stewart and rereviewed for a final decision by the Defense Mobilizer and his aides—a process which will take several months to complete.

Public Bids on Akron Rubber Laboratory Being Asked Now

The fate of the Synthetic Rubber Evaluation Laboratory and Pilot Plant at Akron, O., will be decided early this spring, under a tentative timetable of the government's sales agent—the General Services Administration. The 13-year-old facility, in "mothballs" since June 30, 1956, when the University of Akron turned it back to the government, may never again be utilized for rubber research.

Some time in April or May, the Bureau of the Budget will make a decision on whether to retain the pilot plant/laboratory in government hands or dispose of it to the highest non-government bidder. By that time, GSA spokesmen said in December, it will have turned over to Budget Director Percival Brundage the complete portfolio and recommendations on Akron—the results of almost a year of study, survey, bids, and negotiation.

The question whether Akron facilities will ever again contribute to the development and improvement of synthetic rubber has been hanging in the balance since the September, 1956, decision of GSA to survey the 10 federal departments and 14 agencies for possible interest in the land or buildings for any use these 24 entities might have—research or otherwise. The survey, now complete—ranged from "no interest to some interest," with the Department of Agriculture reported to have expressed the most. Agriculture's interest, concentrated in the laboratory facilities only, extends to use of the Akron Laboratory in its program to find more commercial uses for farm products. If any of the other 23 agencies responding to the GSA survey have a more important use, however, the value to that agency would hold the key to disposal.

With all 24 responses in its hands in December, GSA scheduled its final move under the Akron facilities disposal legislation—an invitation this month, through its Chicago office, for bids from non-government interests. The public will have 60 days to look over the property and put a price on it.

By the end of March, GSA will have opened the public bids and scheduled a round of negotiations, if necessary, to get at least one offer as high as or higher than its idea of the "fair market value" for the installation. When this phase of the disposal program is complete—and assuming GSA is able to find a private buyer willing to pay the "right" price—the agency will then forward the Akron facilities portfolio to Budget Director Brundage for a decision.

Brundage must then answer this question: Will the government's best interests be served by a sale to private interests? If he can answer the question "yes"—in effect, find that the return for all or any part of the facility will more than match the highest value placed on Akron by the government itself—he must order a sale. If he cannot authorize disposal, Akron must be turned over to the agency or agencies having the most valuable interest, pending further advice from Congress.

At best, GSA and the Bureau of the Budget have a difficult task.

Louisville Plant To Be Sold without Insistence Upon Manufacture of Butadiene Only Clause?

The Federal Facilities Corp. completed six weeks of futile negotiations on the long-term lease of the alcohol-butadiene plant at Louisville, Ky., last month, then decided to do what Congress had said last spring should be done, but which Congress never got around to authorizing—sale of the facility without the requirement that it be used to manufacture butadiene only.

Reasons for the collapse of rental talks with Union Carbide & Carbon Corp. and Publicker Industries are anybody's guess, but FCC disclosed enough about the unsuccessful negotiations to indicate that it quickly discovered the government could make a better deal by selling Louisville. Significantly, the two companies involved were the only firms to bid earlier in the year when the defunct Rubber Producing Facilities Disposal Commission tried to sell the plant. The government has been losing money under partial operation by Publicker —the Publicker lease expires in April, 1958 —and was probably told by the two bidders that each would be willing to pay a good price, take title, and upgrade the plant for modernized production.

RPFDC succeeded in completing a sales contract on Louisville—the last synthetic rubber plant still in government hands—as its last official action as agent for the government, but the contract was rejected by the House on a technicality. Attorney General Herbert Brownell, asked to clear the sale from the anti-trust standpoint, pointed to language in the disposal legislation which required that any sale must promote a competitive synthetic rubber industry. Since UCC, the successful bidder over Publicker, had indicated it would produce a chemical other than butadiene at Louisville, Mr. Brownell had no choice but to hold that technically, at least, sale to UCC would not promote a competitive synthetic industry, since Louisville would have been taken out of competition in this industry.

In a never-to-be-forgotten performance, House Democrat Carl Vinson, forceful chairman of the Armed Services Committee, swung this committee into line on a proposal to remove the competitive proviso and push through a new bill. Ordinarily, these things are worked out behind closed doors after lengthy argument. Vinson, however, set up a new disposal at an open meeting of the Committee and in a matter of minutes after winding up a hearing on the problem. Out of his committee came a resolution to revive the RPFDC until July 1, 1957, for the specific purpose of putting together more workable legislation, presenting it to Congress early this year, and selling the plant at a higher return to the government.

RPFDC was to have prepared a bill similar to the original disposal legislation with two major exceptions: (1) it would have permitted manufacture of anything the buyer selected; and (2) it would have relieved the buyer of the normal requirement that the plant be available for mobilization output of alcohol-butadiene at any time during the 10-year period after sale. In the rush of other business late in the session, however, the Vinson bill was passed over, and RPFDC went out of business, as scheduled, in September.

When FFC took over administration of the Louisville lease, as the successor agency to the Commission, it quickly offered the plant for long-term, 5-15-year lease. About November 1, the bidders were revealed as UCC and Publicker, the very companies who had fought out the right to buy Louisville only six months earlier. FFC Administrator Laurence Robbins came a cropper on this avenue of disposal, however, and by mid-December FCC decided to abandon its rental attempts and go back to Congress for authority to sell.

It is up to Congress to decide whether, when, and how the plant might be sold. If it takes its cue from the Vinson Committee, which again will have a heavy hand in a new disposal program, Louisville will make its last ton of butadiene on the day Publicker's lease expires in the Spring of 1958, unless the new owner is Publicker itself.

RMA and NTDRA Both Oppose New Federal Tire Tax Method

Two key segments of the rubber industry—represented by The Rubber Manufacturers Association, Inc., and the National Tire Dealers & Retreaders Association—showed a disposition in December to compromise their differences over collection of the federal excise tax on tires and tubes. NTDRA is the driving force behind a proposed change in the excise tax law which, it contends, would relieve independent dealers of an unfair tax burden and put them on an even footing with manufacturers' tire dealers.

After months of complete disagreement, RMA and NTDRA found themselves on the same side of the fence when a House Ways and Means Subcommittee suggested new tax language which would have played havoc with the tire distribution system. The proposed language would levy the tax—now collected when the manufacturer sells the tire or tube—when the item leaves the manufacturing plant "or a warehouse within 20 miles of such plant." Spokesmen for both of the groups warned against the adoption of the quoted language for similar reasons.

Anson G. P. Segur, Lee Rubber & Tire Corp., representing RMA's Tire Manufacturers Division, put it this way:

"The proposed change in imposition of the tax would compel tire manufacturers either to tie up large amounts of tax cash in inventories (with attendant increased working capital requirements) or to attempt to avoid this by carrying all inventories within 20 miles of their plants. The result of such attempt would be either (1) sharp curtailment of service to customers due to building up inventories at plant locations rather than at strategic field points; or (2) a drastic reduction of overall inventories, causing both impairment of customer service and loss of factory employment from the resulting interruptions of work schedules."

Winston W. Marsh, executive secretary-general manager of NTDRA, commented:

"The intent here is to equalize the taxing of independent tire dealers and company-owned stores. This we have urged for seven years. While this recommendation does encompass company-owned stores, it appears that it goes beyond the requirements of the situation and probably includes part of the industry which was not originally intended. . . .

"This will materially decrease the number of warehouse points available to the independent tire dealer and thereby greatly increase his capital investment. With the larger tire dealers carrying as many as 800 different types of tires plus tubes in stock, and with the introduction of the 14-inch tire, the inventory problem grows even without considering the additional capital required to finance the excise taxes.

"Desiring that there be an equality both in distribution and taxing procedures, we recommend that the tax on tires and inner tubes should be levied at the time of sale or at the time of shipment to a manufacturer's company-owned retail outlet."

RMA's Segur, seeing the handwriting on the wall, disagreed sharply with NTDRA's Marsh and Rep. Aime Forand, Rhode Island Democrat who heads the subcommittee and proposed the bill, over the need of any change in the present excise tax structure for tires and tubes. After a stinging attack on the proposal, however, he had this to say:

"However, should the Committee conclude that the 1954 Internal Revenue Code should be amended, then it is respectfully suggested that through the following phraseology this can be accomplished with the least interference with the tire industry's normal and long-established distribution pattern:

". . . a tire or inner tube shall be deemed to be sold by a manufacturer when shipped from the factory or warehouse of the manufacturer to its company-owned retail store."

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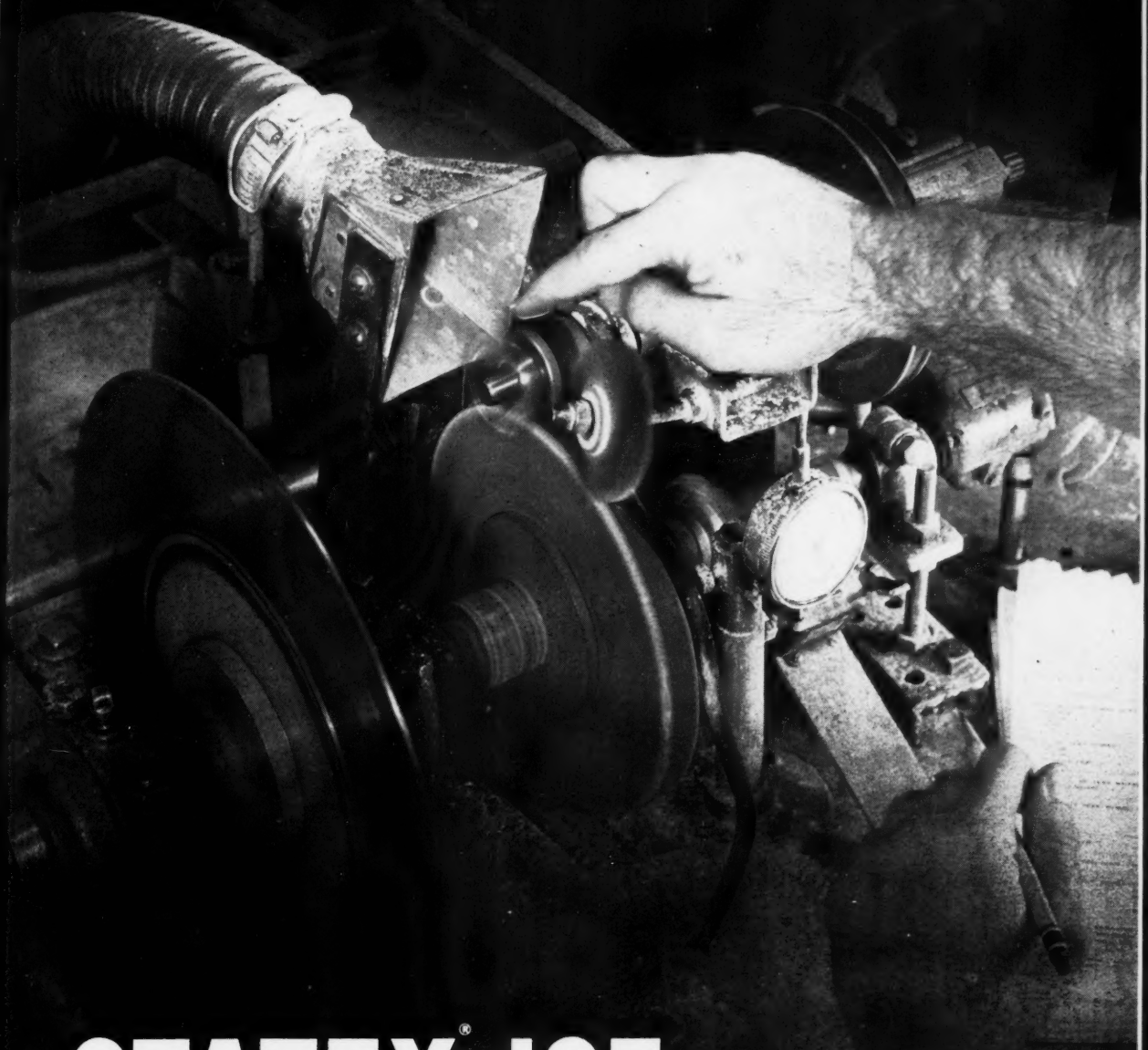

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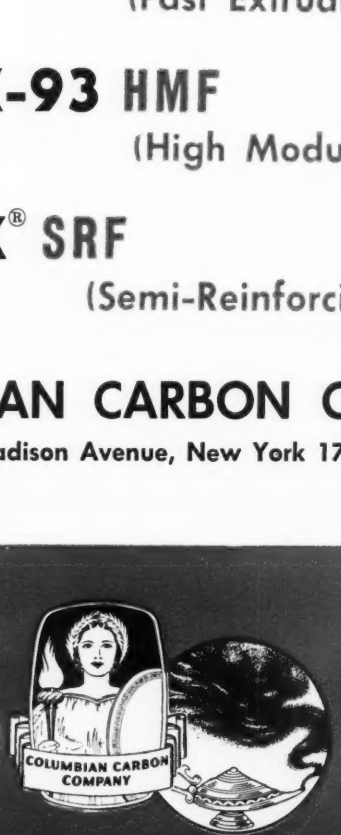


National News

RMA Annual Meeting Hears Shields, Temple, Sears On Industry Growth; Weeks Luncheon Speaker

The Rubber Manufacturers Association, Inc., held its forty-first annual meeting at the Park Lane Hotel, New York, N. Y., November 29. The theme of the meeting was "Rubber as a Growth Industry—Its Problems and Opportunities," and some 200 representatives of the nation's leading manufacturers of rubber goods heard a panel discussion on this subject at which Association President Ross R. Ormsby presided. Sinclair Weeks, Secretary of Commerce, was luncheon speaker.

The Business Meeting

At the business meeting of the RMA board of directors it was voted to enlarge the board from 15 to 18; so three directors were named to fill the newly created directorships, and six others were named either to vacant or expiring posts on the board.

Mr. Ormsby announced that the Firestone Tire & Rubber Co. had been elected to membership in the RMA after many years of full cooperation and constructive participation in its meetings. He noted, also, that Firestone for many years had supported the Association on the same basis as members.

The resignation of P. W. Litchfield, chairman of the Goodyear Tire & Rubber Co., as a director of the RMA, after more than 30 years of service, also was announced. L. E. Spencer, vice president of Goodyear, was named to succeed Mr. Litchfield on the RMA board.

To fill the posts created by the decision to enlarge the board to 18 members, the following company executives were named to serve as directors for one year: L. R. Jackson, president, and Raymond C. Firestone, executive vice president, of Firestone; and T. W. Miller, Jr., president of Faultless Rubber Co.

Five new directors were elected to three year terms expiring in 1959. They are: Thomas Robins, Jr., president, Hewitt-Robins, Inc.; Gen. H. F. Safford, president, Ohio Rubber Co.; J. H. Matthews, executive vice president, Raybestos-Manhattan, Inc.; J. P. Seiberling, president, Seiberling Rubber Co.; and J. W. McGovern, executive vice president, United States Rubber Co. General Safford succeeds the late E. A. Callanan, president, Brown Rubber Co., who died in 1956. Mr. McGovern succeeds H. Gordon Smith, who resigned in September, 1956, as RMA director and executive vice president of U. S. Rubber.

The Panel Discussion

Mr. Ormsby opened the panel discussion program which was pointed at evaluating the industry's role in the growing world economy and at assessing its capability of expanding to meet the challenge of new markets. He specifically called on panel speakers who followed him to appraise the rubber manufacturing industry, as against other industries, in terms of its ability to attract capital funds to support the necessary expansion of its productive capacity.

The statistical background for ensuing discussions of the industry's economic problems and outlook were presented by W. J. Sears, RMA vice president. Mr. Sears' talk, which covered world and United States rubber consumption and the production of natural rubber through 1965, per capita consumption by countries for 1955, proportion of total U.S.A. consumption for tire products and all other, sales of rubber product companies in millions of dollars, corporate income after taxes of rubber compared to other manufacturing companies, and auto and truck registrations from 1940 through 1975, is published in detail as the lead article in this issue.

David Murray Shields, senior partner, MacKay-Shields Associates, and president of Management Economics, Inc., next discussed "Growth of the U. S. Economy and Its Opportunities."

In appraising the outlook for 1957, Mr. Shields said that it is essential that weight be given to the fact that 1956 was marked by a series of far-reaching internal economic adjustments which may well have strengthened our economy against recession. Several major industries, automobiles, housing, farm equipment, and textiles, experienced recessions of considerable intensity. The stock market as a whole has leveled out after years of boom. Yields and price earning ratios are more favorable today than they were at the end of 1955.

The Federal Reserve authorities have steadfastly refused to use inflationary techniques in order to keep money artificially easy and by doing so have probably forestalled a 1956 boom that would have been followed by a bust later on, Mr. Shields said.

Agriculture has adjusted itself to lower income levels, and a variety of influences has checked the rise in agricultural inventories and brought production more nearly in line with consumption. The Federal Government has held off from tax reduction with the result that the federal budget has been showing a modest surplus, and the financial community has accommodated itself to a major advance in interest rates and bond yields.

While inventories have risen in dollar value, the ratio of inventories to sales is believed to have shown little, if any, advance during the year. There has been no wild boom in new orders, with the backlogs appearing to be solid, it was added.

Another factor to which considerable weight must be given in appraising the outlook for 1957 is the economic momentum inherent in the fact that we are spending close to $6 billion per annum for research and development, in carefully drawn plans of business to carry forward substantial programs of plant expansion and improvement, in our road and school building programs, and in the further rise in consumer incomes now assured by a new system of contractual commitments by industry to raise wages by substantial amounts each year for the next one to four years.

As the year 1957 wears on, Mr. Shields said, some subtle changes in economic psychology could easily develop. The conviction now held by some of our businessmen, bankers, and economic observers that the future is to be but a free ride up the growth curves is likely to be replaced by a recognition of the fact that growth is not automatic, but must be earned by hard work, hard competition, and sound planning.

Vincent James, N. Y.

RMA annual meeting panel: *left to right:* W. J. Sears, RMA; Alan H. Temple, First National City Bank of New York; David Murray Shields, MacKay-Shields Associates; and Ross R. Ormsby, RMA

Recent developments in the Near East suggest that our defense outlays will be increased still further and that our production of oil, coal, and perhaps other products will for several months be expanded to provide additional supplies for Europe. Several major industries have recently increased their budgeted production for 1957, and an informal survey of capital expenditures planned by U. S. business projects still another increase in production in our capital goods industries in 1957, it was pointed out. All of this means somewhat higher levels of economic activity than previously expected, and new estimates are given below:

	1955 Actual	1956 Partially Estimated	1957 Projected
Gross national product ($ billions)	391	412	430-435
Disposable income ($ billions)	271	287	298-302
Industrial production (1947-1949=100)	139	143	147-150

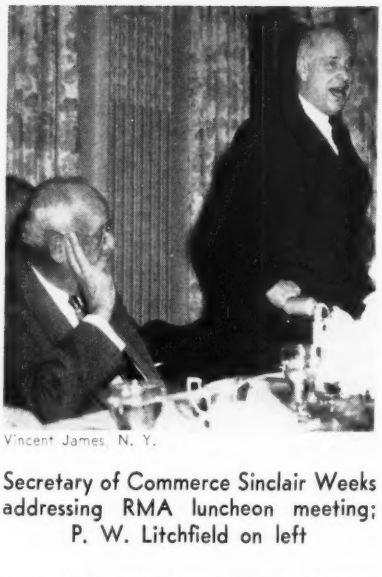
Mr. Shields said that the long-range outlook beyond 1957 is for record breaking expansion. The surge of population is almost certain to continue for many, many years, and starting in the early Sixties the rate of family formation will spurt upward. Our $6 billion per annum outlays for research will produce a whole new series of huge new industries and a long list of fabulous new ways of producing goods at lower and lower real cost so that markets can be widened with consumption and production increased correspondingly.

The road ahead will be a bumpy one, he added, and there will be interludes of recession and of merciless competition. The prospect is that by 1966, however, our gross national product will be reaching for $600 billion in 1956 dollars which would mean that we would attain new standards of economic well being not ever dreamed of by even our wildest optimists.

Alan Harrison Temple, executive vice president, First National City Bank of New York, and editor of its Monthly Economic Letter, spoke on "The Availability and Cost of Capital Funds—The Need for Profits."

As measured by its net worth, the rubber products manufacturing industry of the United States has approximately tripled in size during the past 25 years, Mr. Temple said. As measured by its consumption of new rubber, it has quadrupled in size. These rates of increase mark rubber goods manufacturing as one of our great "growth industries," and reasonable forecasts indicate that this growth will continue, at an inspiring rate, for many years to come.

As a growth industry, however, rubber goods manufacturing must share the general problem of growth industries and ask the general question: "Where is the money coming from?" It is expensive to carry on research and development and to make the outlays for plant and equipment which are necessary to keep up to date, to meet the demands of expanding markets, to improve products, and to keep down costs. An average investment of $12,500 per worker in plant, equipment, and working capital is now required in our economy to maintain our standards of living and progress. If we



Vincent James, N. Y.

Secretary of Commerce Sinclair Weeks addressing RMA luncheon meeting; P. W. Litchfield on left

are to look forward over the next 10 years to an increase of 25% or more in our national product, our capital requirements may be expected to expand in somewhat the same proportion.

Where is the money coming from? The four areas, of course, are depreciation, retained savings, borrowings, and sales of new shares. Each area has its special problems, it was pointed out, the adequacy of depreciation allowances, the effect of corporate taxes on earnings, the availability of savings, and the effect of personal taxation on investment.

In the rubber goods manufacturing industry the necessary increase in capital during the postwar years has been provided to the extent of two-thirds or more by depreciation and retained earnings; a little less than one-fourth by funded debt; and the remainder by increases in common stock, and minor ways. Dividends (as measured by the larger companies) have represented about 35% of earnings.

Earnings of the leading companies in the tire and rubber products industry have in recent years been fairly comparable with those in the manufacturing industries generally. According to our annual tabulations of corporate reports beginning with the year 1925, the average annual rate of net income to net worth or net assets of the rubber group ran somewhat below that of total manufacturing during the late 1920's and the 1930's, but since then the two have run quite close together.

During the active five-year period of 1925-1929, the net income after taxes of the rubber companies represented an average return on book net worth at the beginning of each year of 7.1%, compared with 11% for total manufacturing.

During the depressed 10 years of 1930-39, the average return for rubber was only 3.2%, compared with 5.6% for total manufacturing.

During the World War II years, 1940-45, the rubber average of 11% was slightly above the 10.3% for total manufacturing.

For the decade 1946-55, comprising the widespread postwar business boom, the rubber rate of return of 14.6% was practically the same as the 14.5% for all manufacturing.

For the entire 31-year period covered by our tabulations, the rubber companies realized an average return on book net assets of 9%, compared with the 10.3% average shown for manufacturing companies generally. In the annual comparisons, rubber showed a higher rate of return than total manufacturing in 12 of those years, a lower rate in 18 years, and the same rate in one year.

The improvement in return on net assets has strengthened the investment standing of the rubber companies, Mr. Temple said. Obviously, it is essential to maintain this better showing if the industry's growth is to be successfully financed and its capital requirements, to the extent that they exceed depreciation and retained earnings, are to be successfully met in the public markets without penalty costs.

There was a very active question-and-answer period following the talks by these three panel members, including such subjects as wage-price inflation, depreciation allowances, etc.

The Luncheon Meeting

A special tribute to P. W. Litchfield, retiring chairman of the Goodyear Tire & Rubber Co., was a feature of the luncheon meeting. He received a standing ovation and then in some brief remarks added his endorsement of the future growth and prosperity aspects of the industry.

Commerce Secretary Weeks, in his remarks, also paid tribute to Mr. Litchfield, with special reference to his membership on the Commerce Department's Business Advisory Council.

Mr. Weeks reported that the appeal of the rubber goods manufacturers for relaxation of the natural rubber stockpile rotation procedures in view of the blockade of the Suez Canal had been rejected by the government as not necessary now. He promised prompt action, however, if shortages of natural rubber appear as a result of the loss of the Suez waterway for a long period of time.

The organization and the operation of the Commerce Department and its 11 Bureaus were described by the Secretary. Mention was made of the work of the National Bureau of Standards in the rubber field. A modern method of patent searching which makes use of an electronic eye will become operative in the Patent Bureau in 1957.

Secretary Weeks stated that the government was not favorable to new goals in defense mobilization and expanding the use of accelerated amortization in industry at the present time.

It was suggested that legislation in the field of public transport would be aimed at providing the best service to the shipper at the most satisfactory cost and that such legislation would be aimed at protecting and strengthening common carriers.

Small business will get a better tax break by the present administration and may be permitted to apply depreciation allowances to old as well as new equipment, it was said.

The Commerce Secretary stated he deplored too great concentration of companies into large single units developing in some industries. He concluded by expressing confidence in the business outlook for the next decade.

RMA Sees 1956 Second Best Year on Rubber Consumption; 1957 Use Expected to Approach Record '55 Figure

In terms of rubber consumption, the rubber goods manufacturing industry is expected to make 1956 its second biggest year in history, with about 1,435,000 long tons of new rubber consumed, according to the Rubber Manufacturers Association in its annual round-up of the industry. The outlook for 1957 is better; industry economists now estimate that use of new rubber in this year will approach the record consumption level of 1955, with about 1,510,000 tons expected to be used.

RMA President Ross R. Ormsby noted that although tire sales declined about 9% in 1956, the industry's total volume of business for the year equaled the $5.5-billion sales record reached in 1955. He said that this reflected the vigor of the non-tire segments of the industry which have shown a strong record of growth since World War II.

Coupled with increased new rubber consumption expected in 1957, Mr. Ormsby noted that estimates of tire industry leaders indicate that the tire industry would register production gains of 6% or more in 1957. The strong 1956 market for replacement tires, up 4% over 1955 figures, was an important factor in offsetting the decline in shipments in original equipment tires for the automotive industry during last year. Tire production in 1956 was estimated at 103,451,000, compared with 115,950,000 in 1955. The tire production estimate for 1957 is for more than 110,000,000 units.

The ratio of synthetic rubber use to total new rubber consumption in the United States rose to 60.9% in 1956, in contrast to 58.5% in 1955. The synthetic use ratio is expected by some in the industry to exceed 62% in 1957. Mr. Ormsby said that the entire industry was looking to 1957 as the year in which it could begin wide-scale evaluation of the very promising synthetic "natural rubbers" unveiled by several firms in the past year.

The RMA crude rubber committee obtained the endorsement late in 1956 by 23 rubber producing, packing, trading, and manufacturing associations throughout the world of its new set of international standards. Known as "Type Descriptions and Packing Specifications of Natural Rubber Grades Used in International Trade," this document is now in printing and will be mailed early this year.

Factory employment in the rubber goods manufacturing industry averaged 217,700 production and maintenance employes for the first nine months of 1956, as compared with 213,200 for the same period in 1955.

Sales Record of $6 Billion in 1957, Says Humphreys

Record rubber industry sales of $6 billion in 1957 and an annual rate of $7 billion in 1960 were forecast by H. E. Humphreys, Jr., president of United States Rubber Co., in his year-end statement.

An increase in automobile production will boost the sale of tires and also of many other rubber industry products which go into new cars, he added. Among these are foam rubber, plastic-coated and other fabrics for upholstery, a growing number of plastic items for interior trim, and numerous rubber products such as seals, gaskets, hose, and mountings. A new automotive rubber product, air springs, will be used on a small scale in 1957 cars and may be widely used on 1958 cars, Humphreys said.

Since sales of industrial rubber products always follow very closely the overall activity of American industry and in view of forecasts that the Federal Reserve Board's index of production will advance four to five points in 1957, such products as industrial hose, conveyor belts, and power transmission belts should enjoy a comparable increase in demand.

In estimating new rubber consumption at 1,500,000 long tons in 1957, approaching, but not equaling the record 1,530,000 tons used in 1955, Humphreys pointed out the industry might have record-breaking sales with less than record-breaking rubber consumption. A partial explanation of this situation is that the industry is following a trend toward consumption of less material classified as rubber per dollar of sales. Significant amounts of polyurethanes, polyvinyls, silicone and butyl types of rubbers, which have not thus far been classified as rubber types in the statistics, are now being consumed by the industry.

In addition, the general price level for rubber products increased slightly in 1956 because of higher raw material and labor costs, and these higher prices will be reflected throughout 1957, contributing to the expected increase in dollar sales.

It was pointed out also that the industry is in the midst of a major expansion of synthetic rubber producing capacity, which has risen from 1,150,000 long tons per year in April, 1955, to 1,400,000 tons at the end of 1956, an increase of 22%. Another 20% production capacity will be added by the end of 1957, bringing the total to 1,680,000 tons. Part of this increased capacity for synthetic rubber production will be used to meet the rapidly growing demand for our synthetic rubber in England, Germany, France, Italy, and elsewhere, it was added.

Firestone Expects Top '57 Tire and Air Spring Sales

The year 1956 was one of expansion, growth, and vibrant business activity for rubber goods manufacturers, Harvey S. Firestone, Jr., chairman, Firestone Tire & Rubber Co., said in a statement on December 18. The industry had its second greatest year in both sales and production, with new products and increased demand for thousands of rubber items from hose to mattresses keeping sales volume for all rubber products at a high level.

Gross sales of the rubber product companies will reach a figure of $5.4 billion for 1956, an increase of 57.9% over the 1947 sales volume of these companies of $3.42 billion. Mr. Firestone said the high sales volume reflected the basic stability of the rubber industry.

New 14-inch tires, which began rolling off production lines late in 1956, are expected to account for 80% of the original equipment tires sales in 1957. It was predicted that there would be about 64 million cars and trucks in use by the end of 1957, compared to 61.5 million at the end of 1956.

By the middle of 1957, air springs will be in significant production since these springs are of importance in reducing damage and wear on automobile parts and in giving motorists the smoothest ride they ever had. Air springs should become a vitally important factor in the rubber industry in years ahead, it was said.

Diversification and expansion by the rubber industry enhance its optimistic outlook for the future. Firestone invested a record $58.7 million in new plants, modern production facilities, and expansions during its fiscal year which ended October 31. During the calendar year of 1956 an estimated $180 million was spent by the rubber industry in the United States.

O'Neil Says New Era Begins in '57 Owing to Research

William O'Neil, president, General Tire & Rubber Co., foresees 1957 as the beginning of a new growth era in rubber as a result of the industry's tremendous research and development efforts. The rubber industry for 1957 and for many years to come is confronted with a growing product demand that will challenge the industry's capacity to meet it, he added in his year-end statement.

Air springs for automobiles and trucks were cited as one of the new products of research and development that will create an entirely new demand on the industry's facilities.

O'Neil foresees also not only a greater demand for tires in the replacement market in 1957, but an even greater demand for synthetic rubbers, plastic resins, plastic materials, and basic chemicals, most of which have resulted from recent research and development efforts.

The encouraging outlook for the rubber, steel, food, and oil industries is the indicator pointing to another progressive year in the nation's economy, O'Neil believes.

General Tire's new completely integrated SBR synthetic rubber plant, now under construction at Odessa, Tex., is expected to be in production during the third quarter of 1957.

Thomas Sees Strong 1957 First Half; More Stability

E. J. Thomas, president, Goodyear Tire & Rubber Co., mentioned as guideposts, in viewing 1957, the number of tires produced and the amount of rubber con-

sumed. In all Goodyear estimates, the strength of the first half of 1957 is a little clearer than that of the last half.

Tire production for 1957 of 111,000,000 units, compared to 104,000,000 units in 1956, was given as an indication of expected activity in the tire industry, based on the manufacture in 1957 of 6,500,000 passenger cars and 1,200,000 trucks.

Rubber consumption in 1957 was estimated at 1,510,000 long tons, compared with 1,435,000 tons used in 1956, and it was emphasized that there would be plenty of rubber available both synthetic and natural, and at more stable prices.

The rubber industry, with its increased diversification, now including in addition to tires and rubber products, the many other items such as chemicals, aircraft, electronics, metals, and plastics, tends to be more stable than heretofore when more dependence was placed on tires alone. The new national highway program, as it develops, will give great impetus to increased vehicle registration and, consequently, rubber consumption, Thomas declared.

The year 1957 for the rubber industry should be one of a little higher volume, plenty of capacity to take care of it, continued strong competitive selling, and a tough fight to maintain and improve profit margins, he concluded.

NRB Points To Continuing Need of Natural Rubber

The Natural Rubber Bureau emphasized in its year-end statement that if 1956 proved anything about natural rubber, it proved that it is here to stay. Despite the higher price for natural rubber during the past year, natural maintained the 40/60 relation with synthetic rubber that existed in 1955, accounting for 570,000 long tons of the 1,455,000 long tons of new rubber used in the United States in 1956.

In 1957, with some 1,500,000 tons' consumption of new rubber expected in the U.S.A., if world conditions keep the price of natural well above that of synthetic, the percentage use of natural may go down a point or so, but the total tonnage of natural used should remain about the same.

If the natural rubber producer could control pricing, he would narrow the price gap between natural and synthetic, because a substantial price premium obviously inspires industrial customers to switch to the lower-priced commodity whenever practicable.

NRB pointed out also that further to assure natural rubber's share of the market, scientists in European and Asian research laboratories are working to maintain the quality advantages natural now has and to add others. Rubbers that maintain flexibility and strength at —167° F., cyclized rubber for shoe soling and similar uses, and Heveaplus, a mixture of natural and synthetic resins for electrical equipment and appliances, have been developed.

Extensive work in the field of rubber for roads is being carried out in this country at the NRB research laboratory in Virginia, and stretches of road using varying combinations of rubber and asphalt have been laid down in 42 states, Canada, Cuba, Europe, Asia, Australia, Africa, and New Zealand. Additional stretches of road are planned in a number of states and other countries throughout the world in 1957.

Natural rubber producers look forward with assurance to maintaining their full share of the expanding rubber consumption all foresee for the decade to come.

U.S. Not Infringing Goodrich Tubeless Patent

The civil suit of The B. F. Goodrich Co. against United States Rubber Co. for infringement of the former's tubeless tire patent was dismissed on December 12, 1956, by Federal Judge Watkins in the United States District Court in Baltimore, Md. Judge Watkins ruled that the Goodrich patent was invalid, and that U. S. Rubber was not infringing.

The court stated that the Goodrich tubeless tire has a butyl-type rubber composition covering 100% of the inner surface of the tire. The liner in the U. S. Rubber tubeless tire is not of "butyl-type rubber composition" as that language is employed by Goodrich, it was added. Also, "the omission from U. S. Rubber's tubeless tire of the sealing ribs, or specific liner, or specific extent and termination of the liner (used by Goodrich) would avoid infringement," was emphasized by Judge Watkins.

H. E. Humphreys, Jr., president, U. S. Rubber, in a statement issued the day the ruling was made public said he was glad Judge Watkins had "upheld our position."

"We are glad to learn that Federal Judge R. Dorsey Watkins of the United States District Court in Baltimore, Md., has upheld our position in the tubeless tire patent suit.

"We feel that his decision, based on the facts, is in the best interests of the tire manufacturing industry and, what is more important, the consuming public. His decision gives us freedom to continue our improvement of the tubeless tire through scientific research and development without unjustified patent restrictions. The American motorist can look forward confidently to receiving the best possible value and quality for his tire dollar."

Goodrich Study Underscores Technical Manpower Deficit

The B. F. Goodrich Co. announced early in December the publication of a comprehensive study of trends in scientific and engineering manpower. Emphasized in the foreword of this 28-page booklet entitled, "A Study of the Scientific Manpower Problem of the United States," was the fact that "unless our nation is able to accelerate the rate by which we are training scientists and engineers, we face a possible cumulative inadequate supply of more than 90,000 new scientists and engineers within the next 10 years." Copies of the study were sent to leading industrialists and educators.

Scientists and engineers are currently being graduated at the rate of 186 out of each 1,000 students who earn college first degrees. To meet basic needs of continued growth and expansion of our economy, 205 to 215 out of each 1,000 should become scientists and engineers, the study said. If just 20 to 30 more students out of each 1,000 graduates attained degrees in science and engineering, this deficit in technical manpower could be eliminated.

John L. Collyer, Goodrich chairman, and W. S. Richardson, company president, said the prospect of such a limited supply of scientists and engineers is a threat to the continuing advancement of our nation. They said America must have an adequate supply of "the qualified scientists and engineers needed to bring out and develop the discoveries we need to provide rising living standards for our increasing population." This problem has received considerable attention from a number of groups, including the National Committee for the Development of Scientists & Engineers, appointed by President Eisenhower, and the National Science Foundation, it was added.

The United States now has a total of 950,000 scientists and engineers. In 10 years our need of such technically trained personnel will have increased to 1,379,000, and by 1975, to 2,040,000. Facilities for higher education will have to be more than doubled by 1975. The total number of first degrees to be awarded by colleges in 1957 is estimated at 292,800. By 1975, this figure will rise to about 733,900.

Other Industry News

Firestone's Liberian Plantation Operations Commended In Fifth NPA Case Study of American Business Abroad

The operation of rubber plantations in the republic of Liberia by The Firestone Tire & Rubber Co., Akron, O., has been praised as contributing to that country's social and economic development, in the fifth case study of United States business performance abroad published by the National Planning Association, Washington.

Entitled "The Firestone Operations in Liberia," the 113-page study was written by Wayne Chatfield Taylor, who has served at various times as president of the Export-

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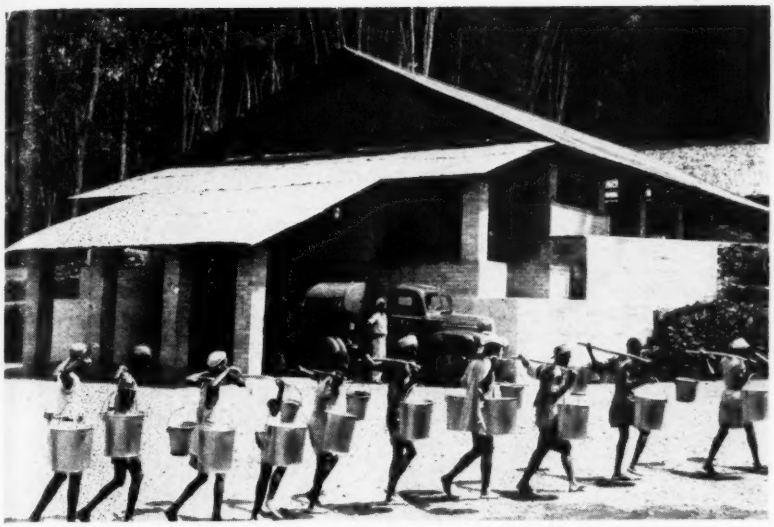


Latex collection station on Firestone's Liberian plantation

Import Bank, Assistant Secretary of the Treasury, Under Secretary of Commerce, and Assistant to the Administrator of the Economic Cooperation Administration.

Mr. Taylor estimated that Firestone accounts for nearly 39% of Liberia's total revenues, more than 70% of the value of its exports, and 35-40% of its dutiable imports. With an average annual payroll of 25,000 Liberian workers, Firestone is Liberia's largest employer and the largest trainer of productive skills in the country.

Liberia has been an independent nation since 1846. It was first colonized by about 13,000 free Negroes from the United States, together with 6,000 Africans rescued from slave-trading ships by the American and British navies. Today it has a population of about two million, of whom only 150,000 are involved in the money economy and political life of the country.

Firestone's operations in Liberia formally began in 1926. Today, through its Plantations Co., it operates two plantations. The larger, at Harbel, contains more than eight million rubber trees on about 90,000 acres. The other, at Cavalla, has two million rubber trees on about 10,000 acres.

In 1955, output of the two plantations was more than 38,000 tons of concentrated liquid latex and coagulated sheet rubber. About 80% of this was shipped in the form of latex, and 20% as baled coagulated sheets. The average yield of 1,048 pounds per acre per year is the highest in the world. The yield is as much as 1,600 pounds on sections planted with newer clones.

Firestone operates two other subsidiaries in Liberia: the United States Trading Co., which is a large-scale importing, wholesaling, and warehousing agency; and the United States-Liberia Radio Corp., which operates the trans-Atlantic radio transmitter and receiver of the company and is a licensed public utility handling messages for the company and the general public.

Firestone's 30 years of activities in Liberia have had an impact that "pervades almost every aspect of Liberian life," Mr. Taylor's report declares. Part of this impact has been the result of a conscious effort by Firestone, "but the rest has been the unintentional though inevitable consequence of the presence of the company in the country, of its attitudes, and of the ways in which it has conducted its business."

Probably the greatest praise that Firestone merits, Mr. Taylor continues, is "its success in resisting the temptation to misuse its preponderant wealth and power" before World War II when resistance by both the Liberians and the United States Government could have had little dissuasive effect.

"The company could have exploited Liberia's) labor, milked the Liberian consumer, corrupted the Liberian government, and run the political life of the country." That it never attempted this "is a tribute to the integrity, self-control, and common sense of the company's officials," Mr. Taylor declares.

"The Firestone Operations in Liberia" may be obtained from the National Planning Association, 1606 New Hampshire Ave., N. W., Washington 9, D. C. The cost is 75¢ a copy to NPA members and $1 a copy to non-members.

Urethane Foaming Slowed

A slower reacting formulation for producing foamed-in-place rigid polyurethanes has been announced by The Dayton Rubber Co., Dayton, O. The longer reaction time widens the safety margin in pouring the mixed polyesters and isocyanates into molds before the resulting urethanes harden in the mixing vessels.

Said to have been designed specifically for rigid materials used in electronic components for aircraft, guided missiles, and torpedoes, the new formulation also gives more uniform and finer pore structure, according to the company. Reaction time has been slowed from the usual 30-60 seconds to 100-180 seconds.

Dayton Rubber prepares custom formulations for both flexible and rigid foams and advises on engineering and production applications of these materials.

Voit Is Bought by AMF

W. J. Voit Rubber Corp., Los Angeles, Calif., the world's largest manufacturer of rubber and rubber-covered athletic equipment, has been purchased by American Machine & Foundry Co., New York, N. Y.

The acquisition was made in a stock-for-stock exchange. Voit will continue operations as a wholly-owned subsidiary of American Machine & Foundry under its present management. The Los Angeles firm, with four plants, grossed more than $12,000,000 in 1955.

AMF has 31 plants and five research and development laboratories in the United States and Canada. Its diverse manufacturing activities include the production of recreational field equipment.

The acquisition will enable Voit to embark on an accelerated expansion program, including "further diversification within the framework of the athletic and sporting goods equipment field," Willard D. Voit, president of the Los Angeles firm, declared.

Du Pont UK Neoprene Plant

A neoprene plant will be built near Londonderry, North Ireland, by Du Pont Co. (United Kingdom), Ltd., with construction scheduled to begin early this year. The company was formed last April and has been providing herbicides of British manufacture for the British market.

The plant will be built on a 381-acre tract four miles northeast of Londonderry and 55 miles northwest of Belfast. Two waterways adjoin the property, the river Foyle on the north and the river Faughn on the east. A major portion of the acreage was the former Maydown airdrome, a military flying field during World War II.

This will be the first neoprene-producing plant in the United Kingdom. During the first eight months of 1956, the UK consumed 2,713 long tons of this synthetic rubber. It imported from the United States 2,517 long tons during the same period.

Monomer MG-1 Licensees

Non-exclusive, non-assignable licenses allowing plastics processors to make plastisol-fabricated vinyl plastics using Monomer MG-1 are being offered by Union Carbide & Carbon Corp. acting through its division, Carbide & Carbon Chemicals Co., New York, N. Y.

Plastisols based on MG-1 produce resins "with a hardness range never possible when conventional plasticizers alone are used as dispersants," the company says. The new plastisol-produced plastics are expected to find markets in flooring tiles, toys, wire coatings, tank linings, foams, and sponge.

The license agreement, based on United States patent No. 2,618,621, allows plastics manufacturers to make, use, and sell vinyl plastisols containing Monomer MG-1, one of Carbide & Carbon's newest commercially available chemicals. Licensees will receive the results of the company's research program on vinyl plastisols.

Eagle-Picher Acquires

The Eagle-Picher Co., Cincinnati, O., has acquired Chicago Vitreous Corp., Cicero, Ill., and its affiliated company, Lusterlite Corp. Chicago Vitreous will operate as a division of Eagle-Picher under its present management.

Founded in 1918, Chicago Vitreous is a producer of porcelain enameling frits and of porcelain enameled steel panels for gasoline service station buildings, which are erected by Lusterlite.

In the past five years, Eagle-Picher has acquired The Ohio Rubber Co., Fabricon Products, Inc., Wilson & Hoppe Plastics, and the zinc properties of Calumet & Hecla, Inc.

New Goshen Rubber

Goshen Rubber Co., Inc., Goshen, Ind., has developed a new non-sticking synthetic rubber compound for its valve seats and other goods. Designated Compound No. 1318, it is said to give quick break-away without lubrication at working temperatures of from –40 to 300° F.

The synthetic rubber material has a 60 Shore durometer hardness which remains unchanged after submersion into No. 1 oil for 70 hours at 212° F., although it shrinks 2.5%. Tested for 70 hours at 212° F. in No. 3 oil, Compound No. 1318 showed a hardness change of –9 and a volume change of +8.7%. The compound is also said to have excellent bonding-to-metal properties.

New Norelco X-Ray Session

The twenty-sixth session of the Norelco X-Ray Diffraction School will be held at the plant of North American Philips Co., Inc., Mount Vernon, N. Y., February 4-8. Subjects to be covered include X-ray diffraction, diffractometry, spectrography, new high- and low-temperature camera techniques, electron microscopy, and electron diffraction.

Applications for attendance should be addressed to the company at 750 South Fulton Ave., Mount Vernon. There is no registration fee.

Materials Handling Show

The seventh national Materials Handling Exposition will be held at Convention Hall, Philadelphia, Pa., April 29-May 3, with "Materials Handling Key to Automation" as its theme. More than 250 companies are expected to exhibit.

Concurrently with the show, the American Material Handling Society will conduct a conference to discuss new developments in handling methods. The Society will also hold its annual banquet during the show period and will present its annual honors and awards.

Advance registration cards may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y., manager of the exposition.

General Sees Sales High

The General Tire & Rubber Co., Akron, O., will sell more than $425 million worth of its products during 1957, a $55-million increase in its estimated sales of $370 million for 1956, and the highest sales volume in its history.

The figures were revealed by M. G. O'Neil, executive assistant to the president of the company, before a meeting of the New York Society of Security Analysts in New York, N. Y., December 4.

Mr. O'Neil also said General Tire's plastics division will have sales exceeding $85 million during 1957, another record figure. The automotive industry's continually increasing need of plastic upholstery and components was cited as the chief cause of the company's plastics boom.

This year will see the full integration of all of General Tire's plastics divisions with Ashtabula, O., as the prime source of raw material, Mr. O'Neil reported. The polyvinyl chloride resin plant in Ashtabula was expanded by 50% in 1956.

The 1957 overall sales estimate includes returns from General Tire's interests in the entertainment and rocket propellant fields.

Goodyear Conveyor Belts In Long-Haul Operations

What is believed to be the world's longest hot-material conveyor belt has been delivered by The Goodyear Tire & Rubber Co., Akron, O., to the Hoyt Lakes, Minn., taconite pelletizing plant of Erie Mining Co., at the eastern end of the Mesabi Iron Range.

The highest capacity belt of its type ever built by Goodyear, it is 42 inches wide and constructed of extra-heavy rayon fabric in six plies, with a special rubber compound forming belt covers.

Hauling hot taconite pellets with temperatures up to 250° F. at a rate of more than 2,000 tons an hour, the belt will operate on a trailing conveyor 1,400 feet long that rides on rails and will feed what is said to be the world's largest traveling belt conveyor stacker.

The stacker and its trailing belt conveyor will be capable of building stockpiles 90 feet high, storing more than 4,000,000 tons of pellets in an area 800 feet wide at the base and 1,300 feet long. A 300-hp. drive motor will move the material on the belt 525 feet a minute.

Goodyear also revealed that another unusual application of its conveyor belts, a so-called dipsy-doodle conveyor, has been placed in operation by Pittsburgh & Midway Mining Co. to haul mined coal 2½ miles at the rate of 900 tons an hour over heavily wooded hills to barges on the Ohio River.

The run consists of three flights of 36-inch-wide conveyor belting, 1,650, 1,450, and 3,100 feet long, measuring from head to tail pulleys. Seven belt conveyors ranging in length from 75 to 650 feet are used for stockpiling and collecting at the coal preparation plant. Three more cross-country flights of 42-inch-wide conveyor belting, 1,700, 2,400, and 2,500 feet in length, are used to move prepared coal to the river.

PCI Plans Ethylene Plant

Petroleum Chemicals, Inc., New Orleans, La., is building a 200-million-pound-a-year ethylene plant at Lake Charles, La., where the company's 80,000-ton-a-year butadiene plant is located. The new plant will be one of the first to offer commercially both standard and high-purity grades of ethylene. This plant is expected to be completed in January, 1958.

Ethylene is used directly or indirectly in the manufacture of such products as synthetic rubbers, polyethylene plastics, anti-freezes, tetra-ethyl lead, and liquid detergents.

Petroleum Chemicals is owned jointly by Cities Service Co. and Continental Oil Co.

Monsanto, Plax Agreement

The plastics division of Monsanto Chemical Co., St. Louis, Mo., has joined forces through a distributorship agreement with Plax Corp., Hartford, Conn., to develop United States markets for Plax's Polyflex 100 series film and sheeting.

The Polyflex 100 series designates biaxially orientated materials made from pure polystyrene. The material is described as a tough, flexible, crystal-clear sheet with an unusually high degree of stability. Its end-uses include formed packages, laminates, photographic film, and base panels for luminous ceilings.

Dow Slashes MDA Price

Dow Chemical Co., Midland, Mich., has reduced by 20-34¢ a pound the price of its p,p'methylenedianiline (MDA), an intermediate used in the making of methylene bis (4-phenyl isocyanate), known as MDI, which shows promise for use in polyurethane solid rubber elastomers, as well as foams, adhesives, and rubber and plastic coatings.

The company believes the price reduction may increase the market for MDI. MDA is also being used as a curing agent for epoxy resins. It is said to give the resin a very high heat distortion temperature, increased hardness, improved resistance to chemical attack, and high strength under sustained stress.

New Timken Research Lab

A $500,000 metallurgical research laboratory will be built by The Timken Roller Bearing Co., Canton, O., to centralize many of its metallurgical research facilities now located in separate buildings.

The new two-story, steel-frame, brick and tile structure will have a floor space of about 11,800 square feet. It will contain office, laboratory, and research equipment, as well as a metallography laboratory and a metallurgical library. Construction is scheduled to start in the spring.

When completed in late 1957, the laboratory will have a staff of more than 75. Daniel J. Girardi is in charge of the company's metallurgical research program.

Rubber Research Under Way at Goodyear Radiation Lab

A $125,000 radiation laboratory, designed for the development of radiation-resistant rubber products, has begun operations at The Goodyear Tire & Rubber Co., Akron, O. The facility is using cobalt 60 as the radiation source.

A primary research target of the new laboratory is the development of radiation-resistant airplane tires that could be used on atomic-powered aircraft. Other goals include the initiation of chemical reactions through irradiation, the polymerization and vulcanization of rubber, and the improvement of the physical properties of plastics and resins.

The cobalt 60 is in the form of slugs 1/16-inch long and 1/8-inch in thickness Nine of these slugs are assembled in an aluminum pencil which is about 10 inches long. The entire source consists of 72 of these pencils.

The new air-conditioned laboratory is a one-story structure, 42 by 24 feet in dimension. Inside is a heavily shielded area, called the cave, for housing the radioactive source. Adjoining it is a physics and chemistry laboratory for the preparation of materials and test specimens and for the evaluation of results and products of irradiation experiments.

Access to the cave from the preparation lab is through a labyrinth of four-foot-wide aisles, a design which eliminates the need of a massive shielding door. The four-foot-thick walls of the cave are of reinforced concrete, and the roof is four feet thick.

Goodyear expects the use of radioactive materials to widen the field of polymerization research. One possibility is said to be the formation of new types of synthetic rubber by adding monomers to a polymer already formed. This would endow a rubber with selective properties such as resistance to certain types of solvents or low permeability to various gases.

Another possibility is that the monomer might be selected to act as a lubricant in the rubber, resulting in less internal friction and low heat generation from flexing. Radiation-cured rubber has excellent aging characteristics or improved resistance to deteriorating effects of heat and oxygen.

S. D. Gehman, left, head of Goodyear's radiation research program, watches through radiation-resistant window while operating elevator winch which raises radioactive cobalt 60 from bottom of water well. T. C. Gregson, a physicist who helped design the new radiation laboratory, checks the intensity of radiation on monitoring instrument.

Witco Ups Wagner

Witco Chemical Co., New York, N. Y., has named Edward F. Wagner, director of the company's technical service laboratory in Chicago, to the newly created post of manager of development in a program designed to broaden the manufacturing activities of Witco and its wholly-owned subsidiaries. Emulsol Chemical Corp. and Ultra Chemical Works. M. M. Gladstone, of Emulsol, and Albert Sharphouse, of Ultra Chemical, will aid Dr. Wagner.

Edward F. Wagner

"Strongest" Aircraft Tire

An aircraft tire claimed to be capable of sustaining more weight per pound of tire than any other tire ever developed has been announced by The General Tire & Rubber Co., Akron, O. Dubbed Aircraft, the 22-inch-diameter, 18-pound tire is being used on the Convair B-58 Hustler, a delta-winged jet bomber believed to be the fastest in the world.

The new tire has a wide flat tread on a considerably smaller-than-average overall diameter. It is made of natural rubber and nylon cord and has restraining plies that maintain its unconventional shape. Other features of the Aircat are secret. General Tire says the tire took two years to develop.

G-E Silicone Sales Names

Milton C. Lauenstein has been appointed manager of the Chicago sales district of the silicone products department of General Electric Co., Waterford, N. Y., and Robert T. Daily has been named manager of the western sales district, with headquarters at Los Angeles.

The two districts were recently created because of the "continued growth in silicone sales and the increasing variety of commercially available silicone products," J. T. Coe, department sales manager, said.

Linear, Inc., Moving Plant

Linear, Inc., Philadelphia, Pa., producer of molded seals and other special molded items, is moving its manufacturing facilities to a recently purchased plant in Dallas, Pa. The new plant has 124,000 square feet of floor space and is zone air-conditioned, permitting controlled temperature and humidity in each of the production areas.

The move will bring to Dallas, which has a population of 1,700, an annual payroll of about $2,000,000 and openings for more than 450 positions with the company.

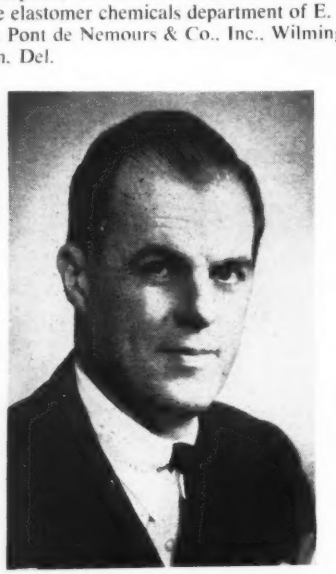
Campco French Licensee

Campco Division of Chicago Molded Products Corp., Chicago, Ill., has licensed Société Plymouth Française, S.A., Feyzin, France, to manufacture thermoplastic sheet by the American firm's process. Plymouth Française is one of France's leading producers of plastic materials and rubber products.

Representatives of the French company will be trained by Campco in the United States in technical and merchandising methods. An "interchange of ideas and machinery" will also take place between the two companies.

Heads of Elastomer Sales Are Appointed by Du Pont

Charles J. Harrington has been appointed director of sales, and Milton H. Campbell, assistant director of sales, of the elastomer chemicals department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.



Willard Stewart, Inc.

Charles J. Harrington

Dr. Harrington was formerly assistant director of sales of the elastomers division, organic chemicals department, which in October became the elastomer chemicals department. He started with Du Pont in 1933 as a chemist, then served successively as a staff member of the engineering department, area supervisor of the Louisville neoprene plant, European office manager of the foreign relations department, and assistant director of the secretary's department.

Mr. Campbell joined the company in 1947 as an automotive engineer, becoming director of the company's petroleum laboratory, assistant director of sales in the petroleum chemicals division, and assistant sales manager for isocyanates in the elastomers division, before his present appointment.

Other assignments in the sales division of the new elastomer chemicals department will be essentially the same as those in the elastomers division of the organic chemicals department. George Holbrook is general manager, and Ernest Bridgwater, assistant general manager, of the new department.

Willard Stewart, Inc.

Milton H. Campbell

Nacconate Plant Operating

National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y., has begun production at its recently completed multi-million-dollar isocyanate plant at Moundsville, W. Va. The plant occupies 15 acres on the company's 210-acre Moundsville site.

National Aniline has been producing isocyanates at its interim Buffalo, N. Y., plant since 1955. The plant will continue to produce new isocyanates developed at the company's research center there. Nacconates is the trade name for National Aniline's organic isocyanates.

The new Moundsville plant is a completely integrated facility with all chemical raw materials supplied within the Allied Chemical group.

"Hypalon" Coated "Fairprene"

A nylon tarpaulin material coated on the outside with neoprene and on the inside with "Hypalon" is being made available by the fabrics division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Called "Fairprene" #5787, the tarpaulin material is said to be completely water, rot, and mildew resistant, and to remain pliable in subfreezing weather. The "Hypalon" coating, identified by its gray color, provides greater resistance to abrasion from cargo or a vehicle.

"Fairprene" #5787 weighs 14 ounces per square yard and is available in 42-, 54-, and 72-inch widths. Other "Fairprene" tarpaulin fabrics are coated on both sides with black neoprene.

Du Pont manufactures and sells only the coated fabric, not the finished tarpaulin.

Plans Airmat Rotor Blades

Goodyear Aircraft Corp., Akron, O., has revealed it is working under contract with the U. S. Navy Bureau of Aeronautics on the development of fabric rotor blades for helicopters and convertiplanes.

The fabric to be used will be the company's Airmat, which consists of two basic layers of high-strength cloth, woven simultaneously with drop treads interconnecting the layers. After weaving, the basic cloths are coated, and cover layers are applied to obtain pressure-tight surfaces of the desired strength.

Airmat was the principal material used in the company's recently announced development of the inflatable rubber airplane. Application of Airmat to a rotor blade will call for lower inflation pressure than for the rubber airplane. In the event of a puncture, the blade could retain its lift through the use of a small accessory compressor.

Plastic Water Pipe Study

An educational campaign to show that plastic pipe is safe for transporting drinking water has been undertaken by the pipe research and education committee of the Society of the Plastics Industry, Inc., in cooperation with the National Sanitation Foundation.

The results of four years of plastic pipe research by the Foundation have been released in a publication entitled, "Study of Plastic Pipe for Potable Water Supplies." This will be directed to educational institutions, the public, and industry.

The Foundation, a non-profit organization, has permitted the use of its Seal of Approval on tested plastic pipe for use with potable water.

Pliovic Coating Organosol

An organosol formulation, based on Pliovic AO vinyl dispersion resin, has been developed for use in decorative and protective coating applications on metal surfaces by the plastics department of The Goodyear Tire & Rubber Co.'s chemical division.

Formulated with 35 parts of plasticizer per 100 parts of resin, the new coating may be brushed or sprayed on such items as sheet stock, machine parts, tool handles, metal ducts, hoods, and machine housings. Chemically stable pigments may be incorporated into the formulation.

The low plasticizer content of the organosol produces a harder coating with less tack and greater chemical resistance than is possible with comparable formulations with higher plasticization, according to Goodyear.

FFC Research Papers

A collection of 363 papers covering synthetic rubber research done for the Federal Facilities Corp. and predecessor agencies during the past two years is being made available to industry in microfilm or photocopy by the Office of Technical Services, United States Department of Commerce, Washington, D. C.

The reports are currently deposited at the Library of Congress and will be reproduced by the Library's photoduplication service. A list of the reports, identified as PB 118310-S, may be obtained from the OTS for 25¢. The cost of the complete set of papers on microfilm is $35. These reports are numbered CR-3571 to CR-3934.

The collection supplements an earlier group of 3,750 papers also available in microfilm or photocopy, identified as PB 118310. The Library will quote prices for single copies of both the earlier and the current reports.

News Briefs

Monsanto Plastics Appoints

F. A. Sherwood, associate director of engineering at the Texas City, Tex., plant of Monsanto Chemical Co.'s plastics division, has been appointed head of a special project to locate and evaluate sites for new petrochemical and polymer operations.

In making the announcement, R. K. Mueller, vice president of the company and general manager of the division, also revealed the advancement of John M. Chamberlin to assistant director of engineering in the Texas City section of the division's engineering department. W. E. Alexander, assistant director of engineering there, will be in charge of major capital projects for the engineering group.

Japanese Geon Expansion

Japanese Geon Co., Ltd., Tokyo, an associate company of B. F. Goodrich Chemical Co., Cleveland, O., has begun production of polyvinyl chloride at its new plant at Takaoka. The facility has an initial annual capacity of 6,500 tons and will employ about 150, but an expansion planned for the next 12 months is expected to make it the largest polyvinyl chloride manufacturing plant in Japan and the Eastern Hemisphere.

The firm's original plant, on the Island of Honshu, has an annual capacity of 3,000 tons, but this, too, is being increased. The combined capacity of the two plants will eventually be 25,000 tons a year, according to B. F. Goodrich.

Gavitt West Coast Plant

Gavitt Wire & Cable Co., Brookfield, Mass., will build a $750,000, 35,000-square-foot wire and cable plant in Escondido, Calif., which is expected to be completed in June. The company is a division of American Hard Rubber Co., New York.

According to R. P. Houlihan, Gavitt general manager, the new plant will permit the company to improve service and offer expanded lines to western customers.

Sawyer-Tower, Inc., coated fabrics division, Watertown, Mass., is coating lightweight nylon tarpaulin fabrics with a compound based on Pliovic AO, a vinyl copolymer dispersion resin made by the chemical division of The Goodyear Tire & Rubber Co.

Pequanoc Rubber Co., Butler, N. J., a subsidiary of American Hard Rubber Co., has acquired a 100-acre site in Tallapoosa, Ga., for the construction of a new custom-compounding plant. The unit will be completed by June.

M. W. Kellogg Co., New York, N. Y., and its French affiliate, Société Kellogg, exhibited Kel-F elastomers and plastics for the first time in France at the recent Fourth International Chemical, Rubber & Plastics Exposition, Paris.

Barrett Division, chemical sales department, is now handling rubber, pharmaceutical, and vinyl chloride resin processing sales of "A-C" Polyethylene Lubricant, formerly known as A-C Polyethylene Wax. Semet-Solvay Petrochemical Division, another division of Allied Chemical & Dye Corp., New York, N. Y., will continue to handle sales of the wax to other fields.

United States Rubber Co.'s Trilok, a three-dimensional fiber-and-polyethylene yarn upholstery fabric produced by the company's textile division, has made its automotive debut on the 1957 Oldsmobile shown at the forty-second National Automobile Show at the New York Coliseum, New York, N. Y., December 8-16.

B. F. Goodrich Chemical Co. has moved its Chicago, Ill., sales office to 2116 Prudential Bldg., Prudential Plaza, Chicago 1.

Burke Rubber Co., San Jose, Calif., will build a new $750,000, 54,000-square-foot plant to replace its 30,000-square-foot plant in operation since 1945. Expanding sales plus the company's anticipated entry into the vinyl floor covering field were said to have necessitated the new plant, which is expected to be in operation by next May. The company makes rubber goods and flooring material. Roscoe Burke is president.

Pennsylvania Salt Mfg. Co., Philadelphia, Pa., has consolidated its Sharples operations with the activities of its industrial chemicals division, creating a new industrial division, with Hugh C. Land as general manager. Included in the new division are the company's plants at Natrona, Pa.; Wyandotte and Riverview, Mich.; Calvert City and Marion, Ky.; and Houston, Tex.

Lion Oil Co., El Dorado, Ark., has joined with four other American gas, oil, and petroleum companies in the acquisition of an oil and gas exploitation concession in Lake Maracaibo, Venezuela.

A. Schulman, Inc., Akron, O., has opened a West Coast office at 1127 Wilshire Blvd., Los Angeles, Calif. Frank M. Francis is manager.

Minnesota Rubber & Gasket Co., Minneapolis, Minn., is making natural and synthetic rubber custom molded gaskets having round cross-sections as small as 0.020-inch, varying shapes, and mitered corners. Dimensional tolerances are as close as 0.001-inch.

Baker Castor Oil Co., New York, N. Y., has appointed Gillies, Inc., Denver, Colo., distributor of its products in Colorado and Utah.

Hooker Electrochemical Co., Niagara Falls, N. Y., has absorbed Oldbury Electrochemical Co., producer of phosphorus, phosphorus compounds, chlorates, perchlorates, oxalic acid and perchloric acid. In addition to its main plant located adjacent to Hooker at Niagara Falls, Oldbury has another plant at Columbus, Miss. For the present, Oldbury will be operated as a division of Hooker.

Hodgman Rubber Co., Framingham, Mass., is marketing a synthetic rubber-fabricated camping air mattress with a tufted outer surface that is said to permit an even shifting of weight and to eliminate the tendency to roll. Called Tuftlite, it consists of a friction coat and a gum coat of The Goodyear Tire & Rubber Co.'s Plioflex synthetic rubber sandwiched between two strong layers of fabric. The tufts are formed by long cotton threads woven to corresponding points on the upper and lower interior surfaces of the fabric.

Apex Tire & Rubber Co., Pawtucket, R. I., is manufacturing multi-colored, one-piece, beach, bathtub, and sandbox toys based on The Goodyear Tire & Rubber Co.'s Plioflex synthetic rubber. Called "Safe T Mates," the toys are being sold in counter-top packages, each containing four toys.

Columbia-Southern Chemical Corp., Pittsburgh, Pa., has begun operations at its recently completed high-grade calcium chloride plant at Barberton, O. The compound is used in tire weighting and refrigeration, among other industrial applications.

Hood Rubber Co., Watertown, Mass., has been awarded a $50,000 contract for 13,582 pairs of men's black rubber knee boots, value, $50,270.60, by the Philadelphia Quartermaster Depot, U. S. Army.

Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., is doubling its synthetic phenol capacity at its Philadelphia, Pa., plant.

B. F. Goodrich Industrial Products Co., Akron, O., has helped develop a bonding film that is replacing rivets in the fuselage, wings, and tail assembly of the Convair B58, the Air Force's newest super-bomber.

Obituaries

Henry Nicholas Ridley

Henry Nicholas Ridley, known to many as the Father of the Malayan Plantation Rubber Industry, died in London on October 24, 1956, at the age of almost 101 years. On December 10, 1955, he had celebrated his hundredth birthday amid the congratulations of many important personages in and out of the rubber world.

Ridley, who claimed among his ancestors Nicholas Ridley, Bishop of London, burnt at the stake in the reign of Queen Mary I, and William Penn, founder of Pennsylvania, was born December 10, 1855.

He took his degree at Oxford with honors, and after various government appointments, was made director in 1888 of the Straits Settlements Garden, Singapore, where he immediately became interested in the possibilities of *Hevea brasiliensis*. He began what were probably the first successfully conducted experiments on the cultivation and tapping of *Hevea* and was the first to publish dependable information showing that *Hevea* planting could be profitable. Ridley prepared the first marketable plantation rubber and at the same time constantly urged planters—to their not always concealed amusement—to grow rubber, presenting them with seeds. Indeed, he was responsible for the distribution of several millions of *Hevea* seeds and plants in Malaya and other tropical countries.

Rubber was not his only interest; his researches in botany, considered by experts to be his most valuable work, earned for him the Frank Meyer Medal for Foreign Plant Introduction (1928) and the Linnean Society's Medal (1950). From the Rubber Growers' Association, he received a Gold Medal in 1914, and in February, 1955, when he was almost 100 years old, the Institution of the Rubber Industry made him an honorary Fellow of the Institute and at the same time awarded him the Colwyn Gold Medal.

Elmo E. Niccum

Elmo E. Niccum, president of Goshen Rubber Co., Inc., Goshen, Ind., died November 24 as a result of an automobile accident.

He was born in Wabash, Ind., September 24, 1904.

Mr. Niccum became vice president of Goshen Rubber in 1924, a year after his graduation from Goshen High School. He was elected president of the company in 1949. He also had been vice president of Syracuse Rubber Products Co., Inc., Syracuse, Ind., from 1943 until his death.

Mr. Niccum was past president of the National O-Ring Manufacturers Association and a member of The Rubber Manufacturers Association, Inc. He was, moreover, a director of the Salem Bank & Trust Co. and a past president and a director of the Goshen Chamber of Commerce, and a director of the Goshen General Hospital. He held memberships in the Masonic Lodge, the Lions Club, the Shrine Club, and the Elks and was moderator and past superintendent of the Sunday School of the First Congregational Christian Church of Goshen.

Elmo E. Niccum

The deceased is survived by his wife, his parents, a son, a daughter, five grandchildren, a sister, and a brother.

Funeral services were held November 27 at the First Congregation Christian Church. Burial was in Violett Cemetery, Goshen.

Robert J. Himmelright

Robert J. Himmelright, president and chairman of the board of Monarch Rubber Co., Hartville, O., died November 23 at his home in Hartville after a brief illness.

Mr. Himmelright was graduated from Miami University in 1920, and served for a brief time as an instructor in accounting at the University of Illinois. In 1921, he came to Canton, O., to assist his brother, the late Paul G. Himmelright, in the management of Monarch Rubber. When the company was reorganized in 1926, Robert Himmelright became its treasurer. He was elected president and general manager in 1940 upon the death of his brother. He became chairman of the board as well as president of the company in 1947 after the death of Howard B. Fawcett.

A veteran of World War I, Mr. Himmelright held membership in the American Legion. He was also a member of the Masons, the Elks, the National Association of Manufacturers, the Rubber Manufacturers Association, Beta Theta Pi and the Trinity Lutheran Church.

The deceased was born in Piqua, O., 58 years ago.

He is survived by his wife, two sons, a daughter, and six grandchildren.

Funeral services were held at Trinity Lutheran Church, Hartville, on November 26. Burial was in West Lawn Cemetery.

Piero Pirelli

News has been received of the death in Milan, Italy, on August 7, 1956, of Piero Pirelli, head of the Pirelli, S.p.A., of Milan. The eldest son of Giovanni Battista Pirelli, who in 1872 had established a factory for the production of mechanical rubber goods, Dr. Pirelli was born on January 27, 1881, in Milan.

In 1903, after completing his studies in law, technology, and business administration at universities in Genoa and Milan, he together with his brother Alberto, his junior by one year, entered into the business. In 1905 the brothers were formally taken into the firm to share with their father the responsibility of its management.

The year before, in 1904, Dr. Piero Pirelli, had visited the United States for the first time, in charge of the Italian section of the World's Fair at St. Louis. The Pirelli firm had by this time become known for its high-tension electrical cables, and Dr. Pirelli took the occasion also to begin negotiations with the Ontario Power Corp. for laying such cable at the Niagara Falls. When his father died in 1932, he became president, and his brother, managing director, of the now internationally known concern.

Dr. Pirelli had many outside interests, among others agriculture and land reclamations, athletics and hunting; he also was a founder, in 1926, of Rotary in Italy.

Paul Luther Fisher

Paul Luther Fisher, superintendent of the reclaim plant of The Goodyear Tire & Rubber Co., Akron, O., died December 3 in a Cuyahoga Falls, O., hospital.

Mr. Fisher taught school for a year before joining Goodyear in 1914, when he was assigned to the production training squadron. Named shift foreman two years later, he continued on production operations in the factory until 1939, when he was appointed general foreman of the reclaim plant. He was named superintendent in 1944.

Mr. Fisher held memberships in the Trinity Lutheran Church, the Goodyear Foreman's Club, the Goodyear 25-Year Club, Joppa Lodge 666 F.&A.M., and Yusef-Khan Grotto and Tadmor Temple of the Shrine. He was a 32nd degree Mason in Stark Consistory, Valley of Canton.

The deceased was born in Thornville, O., on March 15, 1894.

He is survived by his wife, two sons, a daughter and seven grandchildren.

News About People

J. R. Howell, R. W. Lindberg, and **Julian Paul** have been named assistant district sales managers for Carbide & Carbon Chemicals Co., New York, N. Y., in the Chicago, Cleveland, and Boston districts, respectively.

V. W. Wells

V. W. Wells, vice president and manager of the Midwest division of Electric Hose & Rubber Co., Wilmington, Del., has been elected vice president and sales manager, succeeding the late **Edwin P. Rutan.**

Earl L. Whitford, vice president and director of Hooker Electrochemical Co., Niagara Falls, N. Y., has been appointed research coordinator. Dr. Whitford was formerly president of Oldbury Electro-Chemical Co., now Hooker's Oldbury Division. Also named were **Johannes H. Bruun,** as Hooker director of research and development; **Walter H. Prahl,** as director of research and development of Durez Plastics Division; and **James H. Brown,** as manager of research and development for Oldbury. All were formerly associated with Oldbury.

Paul G. Carpenter and **Ross VanVolkenburgh** have joined Copolymer Rubber & Chemical Corp., Baton Rouge, La., as director of research and development and as a supervisor in the research division, respectively. Dr. Carpenter was formerly manager of the synthetic rubber branch, research and development department, Phillips Petroleum Co. Dr. VanVolkenburgh was previously supervisor of organic research for J. M. Huber Corp.

Gerald W. Harris, since 1954 assistant vice president of J. M. Huber Corp., New York, N. Y., has been named vice president in charge of the industrial products department. He joined the company in 1947.

Gerald W. Harris

J. A. Buser and **A. A. Jackson** have been named technical representatives to the New York and Atlanta districts, respectively, of Carbide & Carbon Chemicals Co., New York, N. Y. **R. C. McQueen** has been appointed technical representative to the Kansas City district; while **C. D. Schmidt** has been assigned to the Chicago district.

Paul G. Carpenter

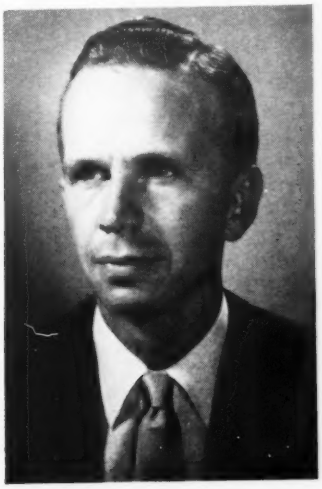
George R. Lawson has been appointed director of marketing for the industrial division of Pennsalt Chemicals, Pennsylvania Salt Mfg. Co., Philadelphia, Pa. He was formerly vice president in charge of sales of the Sharples Division, now a part of the industrial division.

John Marco has resigned as president of Marco Co., Inc., to become president of Marco Development Co., Inc., Wilmington, Del.

Thornton F. Holder, since 1954 research coordinator and patent counsel for Diamond Alkali Co., Cleveland, O., has been named director of research, succeeding **Albert W. Meyer,** who has resigned.

Thornton F. Holder

Robert J. DeLargey has been advanced to director of engineering for the chemical divisions of Food Machinery & Chemical Corp., New York, N. Y. He is succeeded as resident manager of FMC's South Charleston, W. Va., Westvaco chlor-alkali plant by **Neil C. Elphick,** formerly general superintendent at South Charleston.



Ross VanVolkenburgh

William J. Fritton

William J. Fritton has been appointed assistant to the president of U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. He was formerly vice president and a director of Van Der Horst Corp.

Arthur N. Stuart has been advanced to division manager of the manufacturers sales department of The Firestone Tire & Rubber Co., Akron, O.

Dale E. Carver has been named employment manager to The Goodyear Tire & Rubber Co., Akron, O., succeeding the late **A. B. Matthews.**

William L. Rodich, general manager of the laminated products department of General Electric Co., Coshocton, O., has been elected chairman of the laminated products section of the National Electrical Manufacturer's Association.

Ben S. Cottle, Jr., has been appointed to the sales staff of Givaudan-Delawanna, Inc., New York, N. Y., and its associate companies for representation in the northern New Jersey area.

Frank T. Downs has been appointed sales manager for the industrial products division of The General Tire & Rubber Co., Akron, O. He was formerly general sales manager for Houdaille-Hershey Corp. and once served with General Motors Corp.

William K. Wilder, superintendent of the Decatur, Ala., textile mill of Textile Mills division, The Goodyear Tire & Rubber Co., has been appointed assistant to the division's vice president in Akron, O. Named acting superintendent at Decatur was **Raymond R. Thomas.**

Edwin L. Parker has joined A. G. Spalding & Bros., Inc., Chicopee, Mass., as executive vice president. He was formerly president of Akron Mercantile Co.

Edward R. Zacharias has been advanced to general manager of engineering and manufacturing services for Thermoid Co., Trenton, N. J., succeeding **T. J. Ellis,** who has resigned. **John M. Heagle** replaces Mr. Zacharias as manager of manufacturing.

Leigh Photograph

Edward R. Zacharias

Ferdinand C. Meyer has been promoted to associate director of research in the central research department of the research and engineering division of Monsanto Chemical Co., St. Louis, Mo. His successor as assistant director of research is **Tracy M. Patrick, Jr.,** formerly a group leader in the company's organic chemicals division's research department.

Robert J. Schatz has been advanced to associate director of research at the Texas City, Tex., laboratory of the plastics division of Monsanto Chemical Co., St. Louis, Mo. He has been succeeded as the division's associate director of research by **R. I. Dunlap,** formerly assistant director of research.

Parker B. Smith, since 1954 assistant to the vice president of the chemical division of Borden Co., New York, N. Y., has been advanced to general manager of the division's international department.

Glenn A. Zimmerman has been named manager of new products sales for B. F. Goodrich Aviation Products, Akron, O. He has been associated with B. F. Goodrich and its divisions since 1943.

Frank Andrews has been appointed vice president and general manager of Sid Richardson Carbon Co. and Sid Richardson Gasoline Co., Fort Worth, Tex.

Donald H. Getz has joined the technical department of Polymer Chemicals Division of W. R. Grace & Co., New York, N. Y. He has been assigned as senior process engineer at Clifton, N. J.

John R. Smith

John R. Smith has joined Goodrich-Gulf Chemicals, Inc., Cleveland, O., as sales representative covering Ohio and parts of Indiana and western Pennsylvania.

Wilfred E. Pierpont and **Harold O. George** have joined American Synthetic Rubber Corp., New York, N. Y., as sales representatives to the eastern and midwestern territories, respectively.

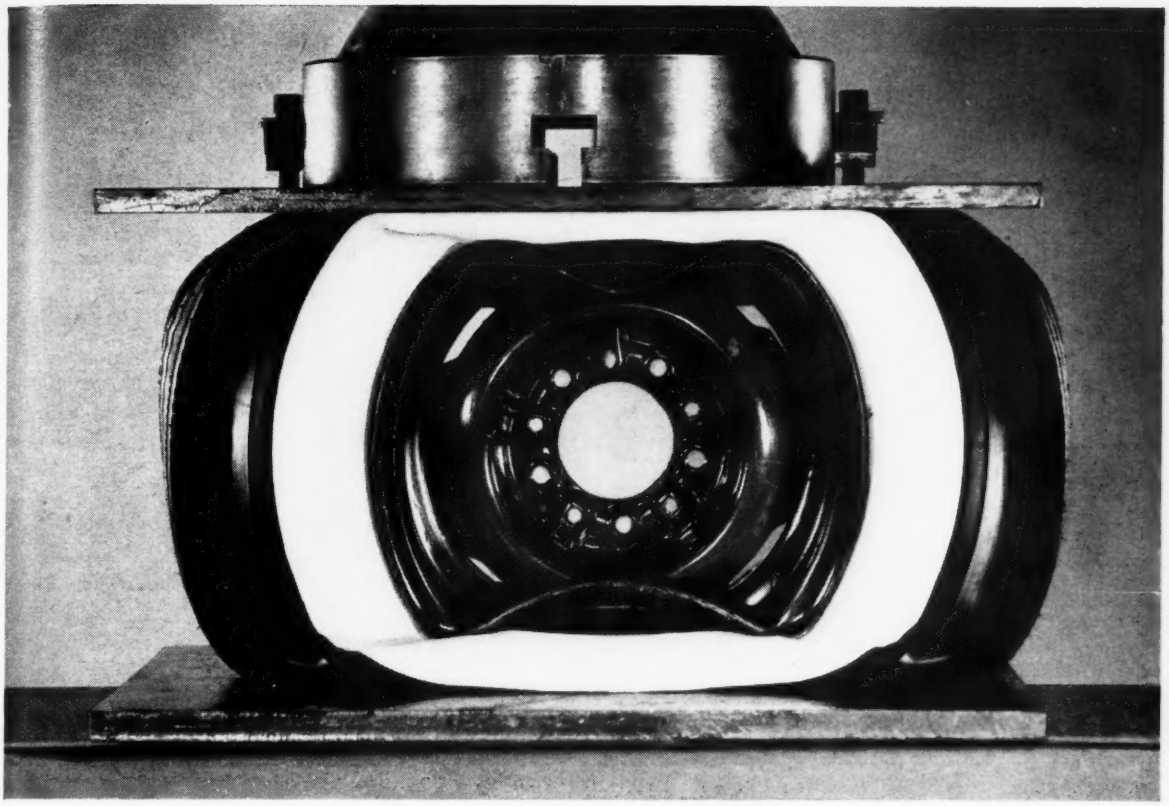
C. W. Blount and **J. D. Benedito** have been appointed vice presidents for marketing and sales, respectively, of Bakelite Co., New York, N. Y.

Charles W. Pennington has been named assistant general manager of the footwear and general products division of United States Rubber Co., New York, N. Y. He is succeeded as general sales manager of consumers' products by **Louis J. Healey,** who is replaced as manager of branch sales by **Arnold H. Finnern. Gregg T. Ward** has been appointed assistant to the general manager, responsible for advertising, sales promotion, publicity, and special assignments.

Charles E. Steen, Jr., has been named general manager of Dural Rubber Co., Flemington, N. J., and **David R. Moyes** has been appointed factory manager. Named head maintenance foreman was **John W. Bender.**

Irwin F. Smith, Jr., has joined the molded products division of Stauffer Chemical Co., Los Angeles, Calif., as an industrial engineer.

Albert Dannenbaum, president of Aldan Rubber Co., Philadelphia, Pa., manufacturer of wading pools, states that the American consumer still favors rubber over vinyl as a coating for wading pools. He attributes the choice to the public's deep-rooted notion that rubber is more waterproof and leakproof. Rubber also provides the best adhesion to cotton and nylon fabrics, Mr. Dannenbaum said.



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H. C. Evans

Maurice H. Bigelow has been appointed technical director in the research and development department of Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., succeeding **C. G. Stupp,** who has retired. **Werner E. Kleinicke** has been advanced to director of research in the department, succeeding Dr. Bigelow. **Bruce T. McMillan,** supervisor of the plastics applications group at Shadyside Applications Research Laboratory, Edgewater, N. J., replaces Dr. Kleinicke as director there. **Wolcott L. Steele,** chief project engineer for Barrett, has been promoted to director of development. **James B. Maguire** has been appointed chemical engineering advisor to Dr. Bigelow.

Randolph H. Jackson has been appointed director of sales for Boston Woven Hose & Rubber Co., Boston, Mass.

Harold D. Dietrich has joined General Magnesite & Magnesia Co., Plymouth Meeting, Pa., as sales representative to the East Coast. He was formerly associated with Celanese Corp. and Boston Woven Hose & Rubber Co.

Carl J. Tsaloff has been named Akron plant manager for B. F. Goodrich Aviation Products, Akron, O.

William J. Snoddon has joined Yale Rubber Mfg. Co., Sandusky, Mich., as director of research. He was formerly senior research chemist for Minnesota Mining & Mfg. Co.

Louis C. Goode has been appointed plant manager of the Moundsville, W. Va., plant of National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y. He succeeds the late **Ross M. Sims.**

Thomas G. Fox, head of the polymers research laboratory of Rohm & Haas Co., Philadelphia, Pa., has been elected chairman of the American Chemical Society's Division of Polymer Chemistry for 1957.

J. P. Haworth and **H. C. Evans** have been named managers of the eastern sales division and the Akron district office, respectively, of Enjay Co., Inc., New York, N. Y. **W. H. Peterson** and **P. C. Richards** have been appointed sales managers of the company's butyl and alcohols and chemicals divisions, respectively. **K. J. Nelson** has been made manager of a new special accounts division.

Arthur Avedon

J. P. Haworth

Joe S. Gilliam has been appointed manager of miscellaneous products sales in B. F. Goodrich Aviation Products, Akron, O. He was formerly manager of government sales in B. F. Goodrich Industrial Products Co., another division of The B. F. Goodrich Co.

Clinton E. Smith has been named assistant to the general sales manager of Pratt & Whitney Co., West Hartford, Conn. He has been associated with the company since 1931.

Gordon H. Lovett has been appointed a technologist at Monsanto Chemical Co.'s plastics division engineering department, Texas City, Tex. He has been with Monsanto since 1946.

W. C. Miller has been elected treasurer of Industrial Rayon Corp., Cleveland, O., succeeding **Allan P. Lucht,** who has resigned. Mr. Miller will continue also as controller of the company.

Donald L. Dewing has been named director of quality control for The General Tire & Rubber Co., Akron, O. He was formerly manager of quality assurance at Aerojet-General Corp.

Morey Weisman has been named sales manager of the plastic specialties division of Middletown Rubber Corp., Middletown, Conn., and will headquarter in the company's New York, N. Y., office. The division will mostly merchandise Middletown's vinyl-supported fabrics.

Bo Adamson

Bo Adamson has joined Goodrich-Gulf Chemicals, Inc., Cleveland, O., as a sales representative.

Bernie F. Thomas has been appointed director of public relations for The Dayton Rubber Co., Dayton, O.

Ralph M. Harpin, supervisor, elastomers branch, Aeronautical Materials Laboratory, Naval Air Material Center, Philadelphia, Pa., has transferred to the Naval Air Station, Pensacola, Fla., to become supervisor of the high polymer branch of the Materials Laboratory there.

James W. Hostettler has joined The General Tire & Rubber Co., Akron, O., as special representative for synthetic rubber sales.

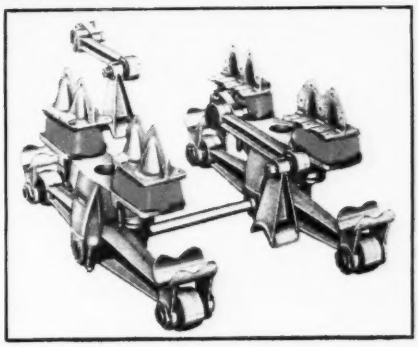
Louis J. Fulop has been appointed manager of de-icer and Rivnut sales in B. F. Goodrich Aviation Products, Akron, O.

Fred Miller has joined the sales and engineering staff of Automotive Rubber Co., Inc., Detroit, Mich.

John Peterson has joined Polymer Chemicals Division of W. R. Grace & Co., New York, N. Y., as sales manager of the midwestern region with offices in Chicago, Ill.

Quaker Rubber Division of H. K. Porter Co., Inc., Philadelphia, Pa., has built for the government a discharge hose more than 250 feet long, believed to be the longest continuous hose of its type ever made. The 800-pound hose has an inside diameter of four inches and withstands pressures of 250 psi.

Naugatuck Chemical Division's Surfa-Aero-Sealz, a synthetic rubber-tar material has been laid over more than 400,000 square yards of parking and maintenance areas at Hickam Air Force Base, Hawaii, to provide protection against jet fuel.



The unique design of the "load cushion" accounts for smooth, even rides in the full range of loads, empty to full. Enjay Butyl Rubber (in red) made it possible.

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Financial

Firestone Tire & Rubber Co., Akron, O., and subsidiaries. Year ended October 31, 1956: net earnings, $60,538,848, equal to $7.43 each on 8,112,444 common shares, compared with $55,378,916, or $6.81 each on 8,082,636 shares, in the preceding fiscal year; net sales, $1,115,179,793, against $1,114,870,187; domestic and foreign income taxes, $59,250,000, against $58,900,000; current assets, $481,955,745, current liabilities, $160,674,630, against $433,674,077 and $125,488,750, respectively, on October 31, 1955.

General Motors Corp., Detroit, Mich. Nine months to September 30, 1956: net earnings, $639,585,399, equal to $2.28 a share, contrasted with $912,887,537, or $3.31 a share, in the 1955 months.

Glidden Co., Cleveland, O. Quarter ended November 30, 1956: net profit, $1,995,048, equal to 87¢ a share, against $1,939,978, or 85¢ a share, a year earlier.

B. F. Goodrich Co., Akron, O. First nine months, 1956: consolidated net income, $30,667,340, equal to $3.44 a common share, compared with $32,395,212, or $3.66 a share, a year earlier; net sales, $538,646,156, against $561,924,350.

Goodyear Tire & Rubber Co., Akron, O. First nine months, 1956: consolidated net profit, $45,349,415, equal to $4.46 a common share, compared with $43,659,193, or $4.30 a share, in the 1955 months; net sales, $1,010,571,802, against $1,025,447,705.

Hercules Powder Co., Wilmington, Del. First three quarters, 1956: net profit, equal to $1.66 a common share, against $1.73 a share, in last year's months; sales, $177,544,464, against $169,791,798.

Imperial Paper & Color Corp., Glen Falls, N. Y. Third quarter, 1956: net profit, $404,122, equal to 79¢ a share, compared with $324,777, or 64¢ a share, a year earlier.

Johnson & Johnson, New Brunswick, N. J. Nine months to September 30, 1956: net earnings, $10,699,000, equal to $5.09 a share, compared with $9,217,000, or $4.38 a share, a year earlier.

Koppers Co., Pittsburgh, Pa. Nine months ended September 30, 1956: net income, $9,427,030, equal to $3.91 a common share, against $7,499,915, or $3.54 a share, a year earlier.

Mansfield Tire & Rubber Co., Mansfield, O. Nine months ended September 30, 1956: net income, $1,113,359, equal to $1.82 a common share, against $1,344,504, or $2.30 a share, in the same period the year before; net sales, $48,039,443, against $58,788,309.

McNeil Machine & Engineering Co., Akron, O. Nine months to September 30, 1956: net profit, $2,183,877, equal to $3.68 a share, compared with $1,698,298, or $2.94 a share, a year earlier.

Minnesota Mining & Mfg. Co., St. Paul, Minn., and domestic and Canadian subsidiaries. January 1-September 30, 1956: net profit, $27,202,398, equal to $1.61 a common share, compared with $24,967,380, or $1.50 a share, in the corresponding months of 1955; net sales, $235,948,905, against $202,713,004.

Mt. Vernon Mills, Inc., New York, N. Y. January 1-September 30, 1956: net income, $1,018,246, equal to $1.35 a share, compared with $788,139, or $1.20 a share, in the same months of the preceding year.

National Automotive Fibres Co., Trenton, N. J. First three quarters, 1956: net loss, $937,695, contrasted with net profit of $1,576,885, or $1.45 a share, a year earlier.

National Lead Co., New York, N. Y. Nine months ended September 30, 1956: net earnings, $41,536,709, equal to $3.49 a share, compared with $34,207,846, or $2.86 a share, in the corresponding months last year.

National Rubber Machinery Co., Akron, O. First nine months, 1956: net income, $600,041, equal to $3.06 a capital share, compared with $451,102, or $2.31 a share, in the 1955 months; net sales, $11,251,750, against $8,285,778.

Nopco Chemical Co., Harrison, N. J., and subsidiaries. First three quarters, 1956: net income, $1,149,150, equal to $2.28 a common share, compared with $1,081,850, or $2.17 a share, in the corresponding period of 1955; sales, $19,826,822, against $17,272,502.

Pennsylvania Salt Mfg. Co., Philadelphia, Pa. Nine months to September 30, 1956: net earnings, $2,938,838, equal to $2.36 a share, against $2,663,251, or $2.14 a share, in the 1955 quarters; net sales, $54,906,207, against $51,469,951.

National-Standard Co., Niles, Mich. Year ended September 30, 1956: net income, $2,757,937, equal to $3.61 a share, against $2,479,640, or $3.28 a share, in the preceding fiscal year.

New Jersey Zinc Co., New York, N. Y. First nine months, 1956: net income, $1,499,353, equal to 77¢ a share, contrasted with $3,696,940, or $1.89 a share, a year earlier.

Okonite Co., Passaic, N. J. Nine months ended September 30, 1956: net earnings, $1,208,209, equal to $6.24 a share, against $1,123,261, or $6.19 a share, a year earlier.

Parke, Davis & Co., Detroit, Mich. First nine months, 1946: net income, $12,209,545, equal to $2.49 a share, compared with $9,528,480, or $1.94 a share, in the same period of 1955.

Phelps Dodge Corp., New York, N. Y. Nine months to September 30, 1956: net profit, $68,424,037, equal to $6.75 a share, contrasted with $46,718,438, or $4.61 a share, in the 1955 period.

Phillips Petroleum Co., Bartlesville, Okla. Nine months to September 30, 1956: net earnings, $71,570,432, equal to $2.08 a share, compared with $65,189,370, or $1.90 a share, in the like period last year.

Pittsburgh Plate Glass Co., Pittsburgh, Pa., and subsidiaries. January 1-September 30, 1956: net earnings, $42,793,551, equal to $4.35 a capital share, contrasted with $45,377,010, or $4.61 a share, in the same months of the preceding year; net sales, $438,576,634, against $428,949,999.

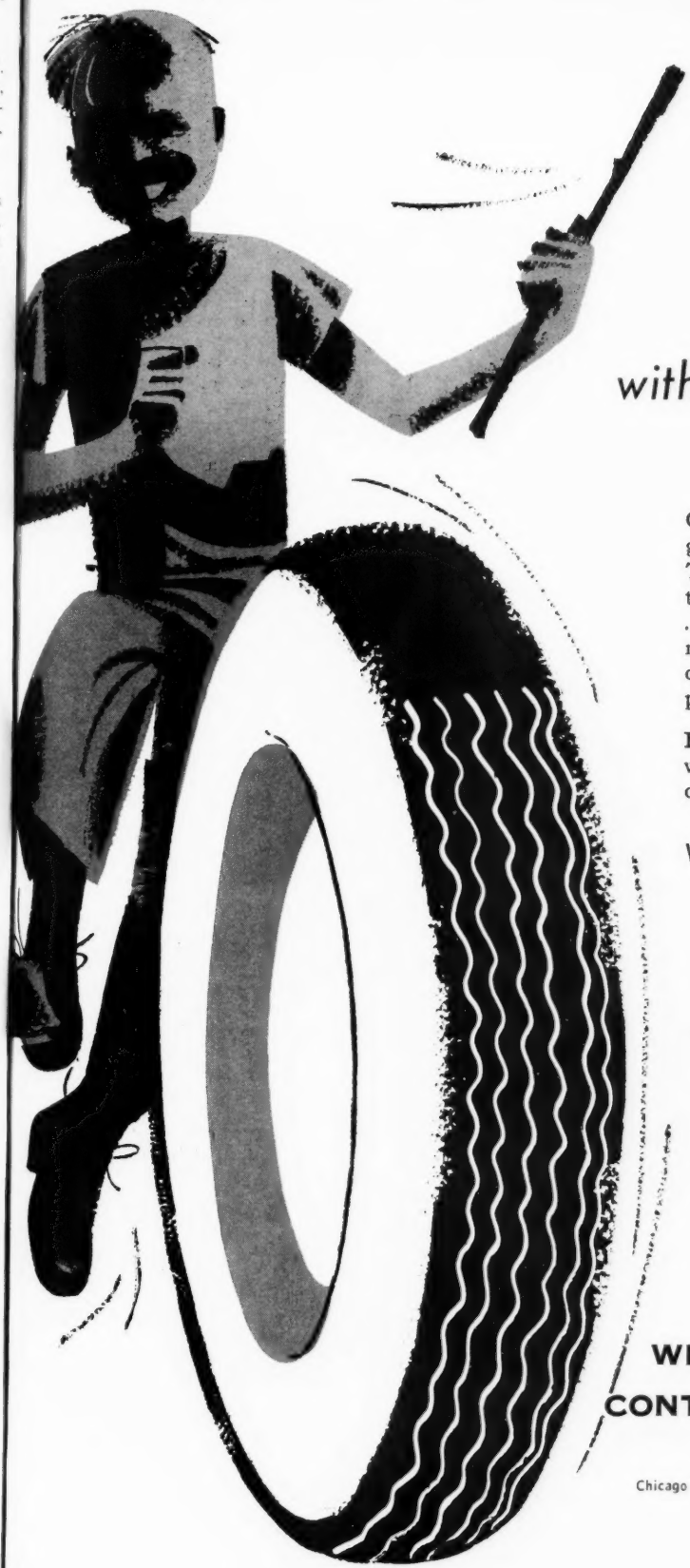
H. K. Porter Co., Inc., Pittsburgh, Pa. Nine months ended September 30, 1956: net earnings, $5,636,924, equal to $5.24 a share, compared with $3,112,844, or $3.00 a share, in the 1955 period.

Rome Cable Corp., Rome, N. Y. Six months ended September 30, 1956: net income, $1,181,000, equal to $2.23 a share, compared with $851,000, or $1.68 a share, in the same months the year before.

J. O. Ross Engineering Corp., New York, N. Y. First half, 1956: net earnings, $40,754, equal to 9¢ a share, contrasted with net loss of $81,006 a year earlier.

St. Joseph Lead Co., New York, N. Y., and subsidiaries. 1956 quarters ended September 30: net profit, $7,371,129, equal to $2.71 a capital share, contrasted with $9,142,890, or $3.37 a share, a year earlier; net sales, $87,594,288, against $90,724,687.

Shell Oil Co., New York, N. Y., and subsidiaries. First nine months, 1956: net income, $100,143,561, equal to $3.64 a capital share, contrasted with $85,646,413, or $3.11 a share, in the 1955 months; sales, $1,192,575,056, against $1,087,262,388.



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News from Abroad

Malaya

Work on Skim Rubber and Serums Shows Promise

How to utilize skim rubber, prepared from the watery fraction left after concentration of field latex by centrifuging or creaming, has become a problem since more and more of it is becoming available. This problem it is being attempted to solve with the aid of the Research Association of British Rubber Manufacturers (RABRM). The R.R.I. sent samples of skim rubber from Malayan estates to the Association in England for testing; and a summary of preliminary results on scorch and curing behavior of skim rubber, as compared with pale crepe and RSS 1 (TC Rubber, Yellow Circle), was published in the *Planters' Bulletin* of November, 1956.

The excessive scorching of most skim rubbers was found in compounds employing acidic accelerators, such as mercaptobenzothiozole, but not with a basic one, such as butyraldehyde aniline. With the latter type, samples of skim rubber cured no faster than ordinary smoked sheet or crepe. Some of the samples had been treated in Malaya to reduce the amount of non-rubber constituents, and these samples showed scorch and cure rates tending to normal. Practically all the samples gave harder, stiffer vulcanizates than normal rubbers, regardless of the type of accelerator.

The copper content of the samples varied greatly and was in some cases excessive; however, results of accelerated aging tests suggest that the copper may not be present in a very injurious form.

Variability appeared to be the main drawback of skim rubber. But some of the effects of variability can be evened out and the scorching trouble obviated, in 50/50 blends of skim rubber with styrene-butadiene rubber (SBR); at the same time the slow curing rate of the SBR is improved. RABRM hopes that research in its own and in other laboratories will help point the way for the ready use of skim rubber in the rubber goods plants.

The same issue of *Planters' Bulletin*, has a note on the use of skim serum and sheet serum—now going to waste in Malayan factories—as a good basis for a cheap culture medium for bacteria. As a sideline of microbiological work on latex at the R.R.I., it was found that on a laboratory scale many varieties of bacteria can be grown and certain antibiotic effects demonstrated by the use of these serums. Possibly antibiotics or vitamins could be produced locally on a commercial scale, it is thought, but it is added that many technical difficulties are in the way even of a pilot-plant operation.

Red China Trade Outlook

Leaders of the rubber section of the Singapore and Federation Trade Missions to Red China have returned to Malaya with stories of the industrial progress being made there and the resultant expansion of rubber needs. Gan Teck Yeow, secretary of the Federation Mission, thought that China was in a position to stabilize the world rubber market if trade could be developed normally in the next two years. China's annual requirements in rubber could not be revealed to him, Mr. Gan stated, but his own opinion, based on the "unbelievable way" in which transport was developing in China, was that she would need about 150,000 tons of rubber for 1957. He made the added point that all restrictions on the use of rubber there had been abolished since the embargo on rubber was lifted.

Low Yoke Kee, who headed the Singapore Mission, thought China's present consumption of more than 100,000 tons of rubber would rise to 200,000 tons in two years' time. China's expanding economy and industrial and agricultural development would demand increasing supplies of rubber. He added, however, that the future of Malaya's rubber trade with China would depend largely on how honest and reasonable merchants in Malaya would be in their dealings with that country. The Chinese seemed especially concerned about receiving the standard of rubber ordered. Japan, which the mission also visited, had promised to buy 80% of her requirements from Malaya next year, Mr. Low said, although she had complained that consignments had not been up to standard. He stated further that he had advised Japanese customers that if they did not try to buy below the market price, they would get the merchandise contracted for.

Research and Replanting

The government fully appreciated the importance of an adequate and effective rubber research program both to the industry and the country as a whole, the Assistant Minister for Commerce & Industry stated in the Federal Legislative Council last November, and it is prepared to give "sympathetic consideration" to the question of financial aid for research when the industry has outlined its program for the next five years.

What the program will be and how much money will be required will depend on the report of the Blackman mission, scheduled for December publication. It may be recalled that the mission, headed by Prof. E. Blackman, visited Malaya in July, 1956, to collect facts on which to base a research and development program for the rubber industry which would make it more competitive with synthetic rubber. Its recommendations are awaited with interest.

The Federation Government had backed a five-year research plan from September, 1948, to September, 1953. But since then all research and development have been paid for out of private funds of the rubber producing industry, and no long-term research has been undertaken since 1953.

A record amount of replanting with high-yielding material was done by estates during 1956, reports indicated, the Minister for Commerce & Industry informed the Federal Legislative Council in November when the budget was discussed. The Minister supported the $280,000,000 (Straits) replanting scheme approved by the former government, and he warned that the future of the natural rubber industry, and with it, the economic future of the country, depended on the result of the struggle between natural and synthetic rubber. Replanting with high-yielding material was the "powerful weapon" with which the Malayan industry had been provided by science for the conflict. Replanting grants would cost the government $30,000,000 (Straits) in 1957, he went on, but the welfare of the industry was at stake.

On the heels of these pronouncements followed the announcement of the Minister for Agriculture that the Federation Government has long-term plans to make Malaya less dependent on rubber by encouraging the production of rice, coconuts, coffee, cocoa, oil-palms, and fruits. Apparently the government has already decided to go slow on rubber replanting schemes in Northern Malaya and to favor rice production there instead.

New Labor Demands

Toward the end of November, the National Union of Plantation Workers held its first biennial delegates' conference, at which it was resolved to place several new demands before estate owners. First, the MPIEA was called on to fix a weekly day of rest for the country's 320,000 plantation workers—that is 52 additional free days a year. Next, the Association was asked to set up a joint industrial council to replace the existing joint consultative council which, it was pointed out, is only an advisory body. This demand is understood to have the support of the Malayan Estates Staff Union.

Another resolution required discussion between the Union and MPIEA on a new wage agreement for workers on palm oil, tea, coconut, and rubber estates. The fixing of a standard task for rubber tappers, with proportionately increased pay for those exceeding this standard, was another demand.

Brazil

Synthetic Production Here?

In Brazil, plans seem to involve not only increased natural rubber production, but the manufacture of synthetic rubber as

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well. While Firestone and the Amazon Credit Bank are experimenting with Sernambi and with Manicoba, Mangabeira, and other types of rubber, respectively, the Natural Petroleum Council is considering means to increase production of aromatics, particularly benzene, for an eventual synthetic rubber industry in Brazil.

At the rate at which road transport in Brazil is developing, the nation will have to import 200,000 tons of rubber during the next five years. Dr. L. M. de Melo, chief of the Petrochemical Section of Petrobras, reportedly estimated; this would cost the country $150,000,000 at current prices. But $30,000,000-$40,000,000, plus expenditure in cruzeiros for local materials and labor, would pay for the installation of a synthetic rubber factory with annual capacity of 40,000-50,000 tons. Such an industry would, naturally, have to be assured of adequate raw material, and to this end Petrobras plans a 90,000-barrel-a-day refinery to be built in Rio de Janeiro.

Rubber Use Fluctuates

According to official statistics from the Executive Commission for the Defense of Rubber, Rio de Janeiro, the Banco de Credito da Amazonia in 1955 bought 20,673 metric tons of locally produced natural rubber for the Brazilian rubber industry, against 21,291 tons in 1954. Consumption of all categories from all sources came to 46,307 metric tons and 45,218 metric tons, in 1955 and 1954, respectively, as follows:

	1954	1955
Natural rubber*		
Latex†	895	895
Reclaimed rubber	6,588	6,308
Synthetic rubber	214	322
Latices	21	72
Total	45,218	46,307

*Including imports.
†Imported.

Monthly figures reveal that consumption in the period January-July, 1955, averaged well over 4,000 tons a month, but fell to about 3,400 tons during the last five months of the year, with a low of just under 3,000 tons in August. Consumption of natural rubber and latex by the different branches of the rubber industry (in metric tons) follows:

	1954	1955
Tires for motor vehicles	26,011	26,661
Inner tubes motor vehicles	1,867	1,714
Cycle tires and tubes	353	473
Tire repair material	2,236	2,562
Heels and soles	191	240
Electric wires	512	481
General goods	7,225	7,474
Total	38,395	39,605

Tire production advanced somewhat in 1955, when 2,185,295 tires for motor vehicles were produced, against 2,054,246 units the year before; included were the following main types for:

	1954	1955
Buses and trucks	856,058	845,090
Light wagons	95,917	88,559
Passenger cars	1,015,020	1,156,650
Motor cycles	19,011	28,568
Agricultural equipment	39,795	40,355

Output of inner tubes for motor vehicles totaled 1,284,698 units in 1954 and 1,215,466 in 1955. Cycle tire production rose from 959,453 to 1,290,384 units, and cycle tubes from 952,636 to 1,214,001 units.

The downward trend in rubber consumption noted in the latter part of 1955 continued through the first two months of 1956, but a recovery occurred in March, and totals for the first quarter of the year came to 10,290 metric tons, against 12,483 tons in the same period of 1955.

Practically all types of goods showed declines in output except bicycle tires and tubes; the former rose from 269,540 to 410,665 units, and the latter from 269,431 to 457,880 units, in the first quarters of 1955 and 1956, respectively. The figures for all types of tires for motor vehicles went down from 591,383 to 498,733 units, and of tubes, from 385,350 to 319,923 units. However, as the rise in March consumption of rubber indicates, there was a sudden spurt in production of tires and tubes for motor vehicles in that month too.

The statistics for January-March, 1956, for the first time give information on the way imports of natural latex and synthetic rubber and latex are employed. In that period 49 tons of natural latex and 29 tons of synthetic rubber and latex went to the tire industry (tire repair materials took four tons of synthetic); 10 tons of synthetic went to the electrical wire industry, and 54 tons of synthetic rubber and 211 tons of natural latex were used in the manufacture of general rubber goods.

Netherlands

Natural Treads Better

Under its climatic conditions the Netherlands can save about 45,000 tires annually by using natural instead of synthetic rubber for tires, according to investigations by Rubber Stichting to compare the effect of temperature on the wear of automobile treads of the two kinds of rubber. The experiments were conducted in Holland, in southern France in mid-summer at temperatures around 86° F., and in Sweden at temperatures around 14° F.

Tires were made of No. 1 Smoked Sheet and of cold SBR rubber, and all had the same tread design; they were mounted on a Ford Mainline fully loaded, which traveled at 100 km/hr (about 62 miles per hour), in dry weather, over flat asphalt or concrete roads, with only gentle curves.

It was found that at low temperatures, say 32° F., the abrasion resistance of synthetic rubber was only 70% that of natural rubber, but the difference decreased with rising temperature. At about 61° F., wear resistance was the same for both kinds of rubber, but above that, synthetic rubber had the advantage.

At 77° F., for instance, natural rubber showed 35% more wear than cold rubber. At average annual temperatures (40-60° F.) prevailing in the Netherlands, relative wear of natural rubber is 13% less than for synthetic rubber, it was found, and this calculated on the life of a tire, and the average annual mileage per car of the 260,000 automobiles in the country, gives a saving of 45,000 tires a year.

Norway

Cellular Rubber Cycle Tire

A cycle tire consisting of the usual cover, but having a molded core of micro-cellular rubber instead of an inner tube, was recently put on the market by the Norwegian rubber company, Sande Fabrikker A/S, in Vestfold. According to an item in *Rubber* (October, 1956), the organ of Rubber Stichting, the riding properties of the Sande tire are exactly the same as those of the usual pneumatic tire; the price of this new tire is higher, but its service life is longer.

The various advantages it offers over the pneumatic tire—no pumping of air, no trouble with valves, no punctures—have reportedly interested military authorities, who have been testing tires of this type and discovered that a 7.6 mm. bullet shot into the tire leaves only a tiny hole the size of a pin head.

The Sande tire has been patented in Norway and is being tried out for motor scooters and other two-wheeled motor vehicles.

Great Britian

A new styrene plant, to cost £1,750,000 (about $4,900,000) is to be erected at Partington, on the Manchester Ship Canal, by Petrochemicals, Ltd., an associate of the Royal Dutch-Shell group. The plant, expected to start operating in 1958, will provide Styrene Products, Ltd., a wholly owned subsidiary of Petrochemicals, with monomer for polystyrene molding powders; The International Synthetic Rubber Consortium will also receive considerable quantities of styrene for synthetic rubber production at Fawley; and further supplies will be made available to industry in general.

The International Synthetic Rubber Consortium, it will be recalled, was formed in November, 1955, by Dunlop, the British branches of Goodyear and Firestone, and Michelin Tire Co., to produce general-purpose synthetic rubber in the United Kingdom. In September of this year its capital was increased to £4,000,000.

Nigeria

Interest in Nigeria as a potential, large new source of plantation rubber continues to grow. E. L. Marsh, of Thomas Barlow & Bros., London, on a visit to the chief rubber area, the Delta Province of the western region, stated his opinion that with sufficient effort Nigeria could challenge Malaya's world supremacy in natural rubber production. His firm, he added, was ready to give financial and other aid if appointed selling agent in London.

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NEW EQUIPMENT

Compression of standard single mattress being tested with Wohler foam tester

Portable Foam Rubber Compression Tester

A foam rubber compression tester, said to be the first portable instrument on the market with which precise compression modulus readings on all types of foam cushioning materials can be obtained in standard RMA-ASTM figures, is being made available by Browning Instrument Co., Bath, O. Called Wohler foam tester, it utilizes the industry standard 50-square-inch compression foot and has specially designed disk weights. According to the company, this device will test all cored foam products up through double mattresses, including reversible furniture cushions. The tester has a maximum compression range of up to 42.5 pounds.

Designed to operate through a non-damaging incision in the top slab of the foam material, the tester requires no calculations since cushion height and deflection are indicated automatically on separate scales. In addition to standard compression modulus testing, the instrument can be used for low-temperature testing in conjunction with a cold box and to determine compression fatigue or drift, as well as hysteresis properties.

The Wohler foam tester, as shipped, includes the compression foot of standard diameter, scales for indicating cushion height and deflection, 10 hand-turned disk weights ranging from ½ to 10 pounds, a surgeon's scalpel, instruction sheet, and felt-lined leatherette carrying case.

Electronic-Hydraulic Control Units

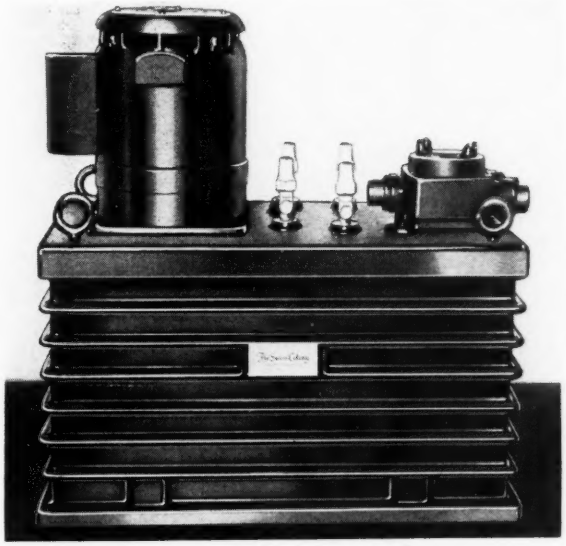
Compact, custom-built electronic-hydraulic units for controlling pressure, vacuum, temperature, liquid level, flow, or condensate drainage in any manufacturing process are being offered by the engineering division of The Swiss Colony, Monroe, Wis. Designated Swisstrol, the units are said to operate with high-speed accuracy without "lag" or "hunting," to provide almost friction-free operation, and to be easy to install and maintain.

According to the company, electronically fast reaction to changes of conditions is instantly transmitted to a hydraulic operator in the Swisstrol. A hydraulically operated valve can be fully stroked as required, providing instant and hunt-free control. Valves are operated by hydraulic cylinders, or, where rotary motion is required, a fluid motor is used. Such operators can be fitted to any type of valve, including conventional sliding stem, butterfly, gate, Saunders-type, and pinch-type valves.

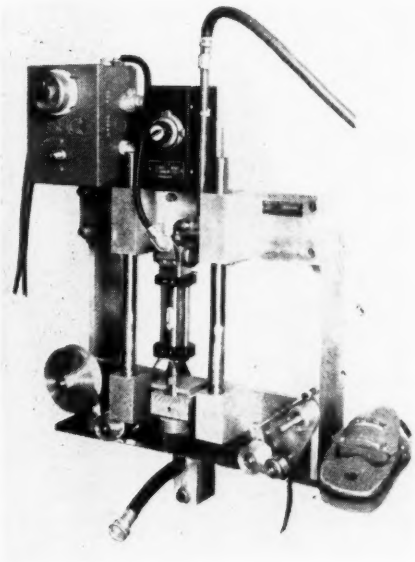
The electronic equipment of most Swisstrol units is contained in a cast-iron case 21 inches wide, 11 inches deep, and 21 inches

high. The electronic equipment consists essentially of specially wound coils and two electronic tubes, one of these a stand-by tube. The only moving part inside the case is a small electronically operated four-way hydraulic valve. A motor-driven hydraulic pump is mounted on the top cover of the case, either horizontally or vertically. All equipment is submerged in an oil reservoir in the case. Oil lines from the pump and the four-way valve have efficient oil filters.

Each Swisstrol is guaranteed for 30,000 hours of operation.



Swiss Colony's Swisstrol

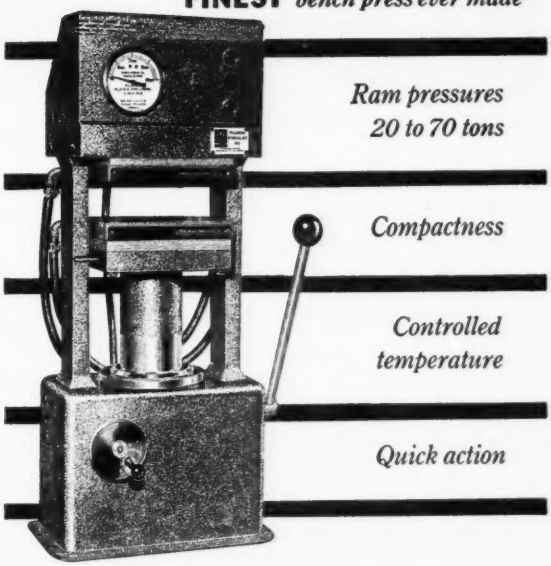


Industrial Marking Equipment's Auto Printer

Air-Operated Hose and Wire Coder

A new air-operated coder for marking such products as hose, wire, cable, and pipe has been placed on the market by Industrial Marking Equipment Co., Brooklyn, N. Y. Called the Auto Printer, the machine is said to imprint all combinations of numbers, letters, and colors for product identification or quality control, regardless of the diameter of the item. The unit employs the permanent roll-leaf method of printing, requiring no make-ready or ink. There is a foot-switch control for one-man operation.

FINEST *bench press ever made*



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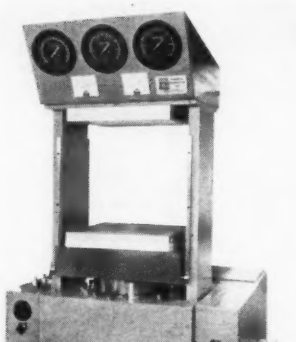
PHI 300-Ton Hydraulic Press



PHI 300-ton press

A 300-ton double-acting hydraulic press has been placed on the market by Pasadena Hydraulics, Inc., Pasadena, Calif. The press is said to have been designed for a wide range of experimental pressing operations which require the application and maintenance of precise pressures through the entire range of the machine: 1,000 to 600,000 psi.

The unit has three pressure gages, covering ranges from 0 to 20,000, 0 to 120,000, and 0 to 600,000 psi. Accuracy is ± 5%. A "Hi-Lo" hydraulic system is provided with a low-pressure control to check the ram speed before the point of close. Two pyrometers permit observation of the temperature of the steam platens in either F. or C. degrees.

The press has a 20-inch daylight opening and a 20-inch stroke. The inside dimension between the uprights is 23 inches; the overall height 78½ inches; and the base, 42 inches square. The platen dimensions are 18½ inches square and are available for either steam or electrical heating and in the latter case are standard in temperatures to 600° F.

Maximum closing speed is 60 inches per minute. The gages and pressure switches are protected against damage when the pressure exceeds limits. A four-point selector permits the operator to select the pressure range required. The hydraulic system and controls are protected against damage from excess pressure.

Patterson Ball and Pebble Mill

A ball and pebble mill for fine grinding of a wide range of materials, including rubber, plastics, colors, and many chemicals and pigments, has been announced by The Patterson Foundry & Machine Co., East Liverpool, O. Called Futura, the mill is said to have such features as accurate water temperature control, high water velocity and greater jacket area to provide faster heat transfer, improved heavy-duty anti-friction roller bearings, inbuilt motor drive on a base cast integral with the mill stand, lightweight door design, continuous water treatment, and a safety guard rail counterbalanced for easy operation.

The Futura is furnished as a chrome manganese steel ball mill or lined with Porox, burstone, or Arlcite. Mill sizes range from four by five feet to six by eight feet. Capacities are from 455 to 1,639 U. S. gallons per batch.

Automatic Tramp-Metal Detector

A device for the automatic detection of ferrous or non-ferrous tramp-metal particles in packaged or bulk materials of a non-metallic nature has been placed on the market by J. W. Dice Co., Englewood, N. J. Designated Model TM metal detector, it is said to be capable of inspecting such products as rubber, plastics, textiles, and ceramics at conveyor speeds up to 1,000 fpm. Contaminated materials passing through a test coil cause a reject relay to operate in the electronic unit. This relay can be used to sound a warning gong, trigger a marking device, or operate a reject gate.

Inspection apertures, moreover, can be made any convenient size and may be mounted in any position to permit passage of the product, the company says.

NEW MATERIALS

Nalco Release Agent Series

A release agent in three viscosity-controlled grades has been placed on the market by National Aluminate Corp., Ill. Called Nalco RA-1 (thick thixotropic), RA-2 (medium), and RA-3 (thin), they are high molecular weight organic chemicals, uniformly dispersed in a non-aqueous solvent, white in color, odorless, smokeless, non-corrosive, and non-toxic.

Although designed principally for use in the die casting of aluminum, zinc, and alloys, they are said to show promise in rubber and plastic molding. They may be applied by spray, automatic injection, or brushing. The company will alter the viscosities of the series to suit special requirements or solve specific problems.

The RA series has a specific gravity at 60° F. of 0.8, weighs 6-7 pounds per gallon, and has a flash point (COC) of 175° F.

A technical bulletin on these release agents is available from the company.

Precipitable Lignin Sulfonate—Orzan P

A new member of a group of surface-active lignin sulfonates is being marketed by Crown Zellerbach Corp., chemical products division, Camas, Wash. Called Orzan P, it differs from the rest of the Orzan series—A, AL-50, S, and SL-50—in its ability to be precipitated, even from dilute solutions, by the addition of alum. The precipitated product clings to fibers or other materials present with it. Also, while dissolved, Orzan P is said to be a good emulsifier and dispersant. It can be used as a binder for fibrous products, as a special-purpose emulsifier and emulsion stabilizer, as a flocculant to speed up the settling of suspended solids, and as a special-purpose dispersant.

A tan powder, completely soluble in water, Orzan P has a bulk density of 22 lb./cu.ft., and a pH of 6 to 7 in 40% solution. It is available in 40-pound asphalt-laminated multiwall paper bags. A 40% solids solution of Orzan P, a medium viscosity liquid, is also obtainable. It is called Orzan PL-40, a dark-brown liquid with a specific gravity @ 77° F. of 1.17 and a pH of 6 to 7.

Orzan A, essentially ammonium lignin sulfonate plus wood sugars present in a fixed proportion to the ammonium lignin sulfonate, can be used as an extender in polyvinyl adhesive, as an ingredient and extender in phenolic resins, and as a coprecipitant in protein precipitation. Orzan AL-50 is Orzan A as a water solution containing 50% solids. Orzan S is essentially spray-dried sodium lignin sulfonate, containing wood sugars in less amount than in Orzan A. Orzan SL-50 is the 50% solids solution of Orzan S. The Orzans can also be used as wetting agents and dispersants for carbon black.

A technical bulletin on Orzan P is available from the company.

Monitor A Organic Sequestrant

An organic sequestrant, solubilizer, or chelating agent for di-, tri-, and tetra-valent metallic ions in aqueous solutions over the entire pH range has been announced by Globe Compound Co., Inc., Waterbury, Conn. Designated Monitor A, it is a viscous neutral hygroscopic liquid which is, chemically, an organic high molecular weight polyhydroxy compound. It is said to be effective in both acidic media and strong caustic solutions, and in dilute solutions has little effect upon surface tension. It is non-foaming by itself.

According to the company, Monitor A will stablize latex and latex-and-resin emulsion paints against the deleterious effects of

(Continued on page 618)

QUICK-CLEAN

steel, iron or chrome-plated

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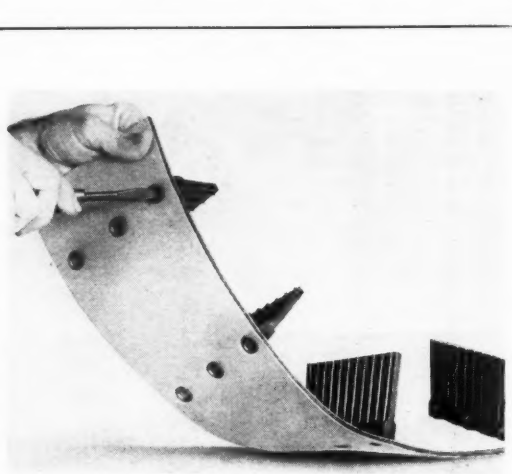
NEW PRODUCTS



"Tatch-A-Cleat" being screwed on sample conveyor

Neoprene Conveyor Screw-On Cleats

Molded neoprene screw-on cleats for conveyor or elevator belts have been introduced by T. H. Hinchcliffe, Pasadena, Calif. Dubbed "Tatch-A-Cleat," they are attached to the belt by flat-head machine screws and special countersunk washers secured to threaded metal inserts vulcanized in the base of the cleat. The inserts are embedded in concave cups. Both screw-head and washer sink below the surface of the belt, where they cannot contact pulley.

According to E. I. du Pont de Nemours & Co., Inc., producer of neoprene, one of the advantages of the cleat is the ease of changing width and height of the cleats and the transfer of cleats to replacement belts. The cleats are available in heights from ⅝-inch to three inches and in widths from 1½ to 24 inches. Other heights, widths, and required rib structures may be ordered.

Armstrong Cork's Stretchless Rubber Belt

A stretchless, seamless rubber belt, made of natural, nitrile, styrene, or neoprene rubber, or in blends of these, has been announced by Armstrong Cork Co., Lancaster, Pa. Dubbed Endless Rubber Belt, it is said to be designed with a sturdy, straight-line cord interliner, vulcanized between two layers of synthetic rubber, that keeps the belt from stretching. The unchanging length eliminates the possibility of slippage in applications where a positive drive must be held to constantly, according to the company.

Suggested applications are as a drive belt on dictating machines, tape recorders, and industrial pumps and compressors; or as a feed belt on packaging machines, duplicating machines, and postage meters. The belts are available in many lengths, widths, and thicknesses, with a variety of cord interliner sizes, and in either black or white colors.

Koroseal Industrial Link Matting

Colored multi-link industrial matting made of Koroseal is being offered by B. F. Goodrich Industrial Products Co., Akron, O. The links are strung on parallel non-rusting spring steel rods, and the mats are finished on all four sides with Koroseal nosing, either square or tapered. The mats resist aging, abrasion, acids, caustics, and oil, according to the company. The Koroseal links are available in any combination of gray, brown, blue, yellow, black, green, white, red, and orange.

New General Tire Commercial Battery

A longer lived and more powerful commercial battery for diesel and gasoline engines in light to heavy trucks and buses has been added to the battery line of The General Tire & Rubber Co., Akron, O. Dubbed Super Expressway, the battery is said to have thicker and higher plates than its predecessors, resulting in a 43% increase in life expectancy. A multiple-plate construction also permits improved starts and more efficient operation, the company claims.

Other features of the new battery include a silver-cobalt rust inhibitor on the positive plates for resistance to overcharge destruction, increased electrolyte over the tops of the plates for better retarding of plate exposure, and a single-unit hard rubber container.

Goodyear Heavy-Duty Bicycle Tires

A new blackwall heavy-duty bicycle tire has been placed on the market by The Goodyear Tire & Rubber Co., Akron, O. Called Suburbanite 175, it has the same-type tread as its passenger-car tire namesake. This new tire is constructed of strong carcass fabric with added rubber in the tread. This all-weather tire is available in 26 x 1.75 size.

Suburbanite 175

Tire for Heavier Trailer Homes

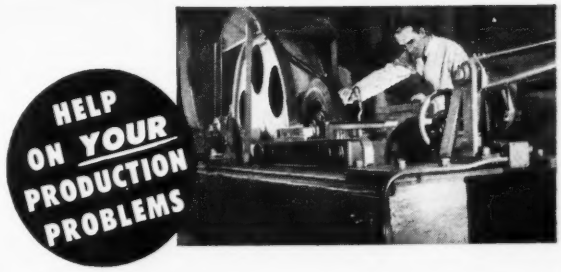
An improved tire for trailer homes, said to be geared to the trend toward heavier and more elaborate vehicles, has been added to the line of The Dayton Rubber Co., Dayton, O. Called Dayton Thorobred Mobile Home, the 15-inch tire has an all-rayon cord construction and is available in tubeless or tubed design. The tread features five continuous - running ribs. The tubeless tire, size 7.00-15, is available in six- or eight-ply rating, which have a maximum load carrying capacity of 1,660 and 1,965 pounds, respectively. The tubed style comes in 7.00-15 and 7.50-15 sizes.

Dayton Home Tubeless

Premium 125 Tread Rubber

A tread rubber that is said to incorporate the best qualities of cold rubber and natural rubber has been developed by The Seiberling Rubber Co., Akron, O., for its independent recappers. Called Premium 125 Tread Rubber, it is said to provide a minimum of 25% more mileage at about a 10% increase in cost over cold rubber. According to the company, the tread compound also contains a heat-dissipating factor much nearer to that of natural rubber, and it also has good molding qualities.

INTERNATIONAL TECHNICAL ASSISTANCE



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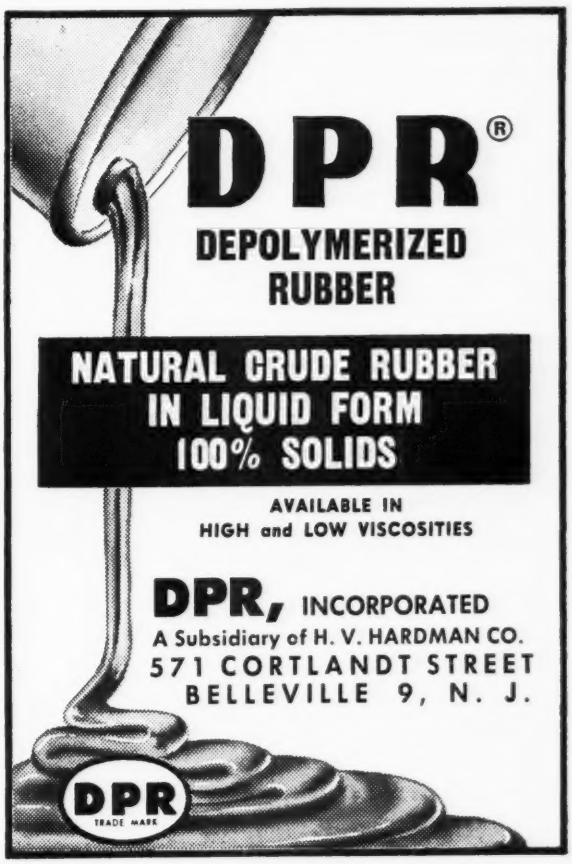

TECHNICAL BOOKS

BOOK REVIEWS

"Manual of Reclaimed Rubber." Edited by J. M. Ball. Published by Rubber Reclaimers Association, Inc., New York, N. Y. Cloth, 6 by 9 inches, 96 pages. Price $3.

The purpose of this Manual is to give the properties and advantages of reclaimed rubber and the principles of compounding it, and to illustrate these principles not only by technical data on laboratory mixes, but also by commercial formulations representing certain large-tonnage uses of reclaim. It is pointed out, however, that these formulations are not intended for use precisely as presented, but rather as starting points from which the compounder may proceed toward particular end-products for specific applications.

The first part of the Manual describes reclaimed rubber, the advantages of its use, and then provides a representative listing of the major types. The compounding of reclaimed rubber with special reference to blends with new rubber and with fillers and softeners, zinc oxide, and accelerators and vulcanizing agents is then discussed and illustrated with typical formulations.

The section entitled, "Commercial Uses of Reclaimed Rubber," comprises 17 pages and includes compounds, curing data and physical properties, and some discussion for various tire, tube, molded and extruded automotive goods, belting, sole and heel, electrical insulation, etc., formulations.

The final section and appendix give physical and chemical test methods selected from publications of the American Society for Testing Materials and other sources. A bibliography of important articles and books dealing with reclaimed rubber from 1934 through 1956 concludes the Manual.

This new publication of the Rubber Reclaimers Association should be of value to all rubber technologists and particularly to those who have recently started a career in the rubber industry. In these days when the number of elastomers, both natural and synthetic, is legion, some technologists need to be reminded that "reclaimed rubber is a high-grade compounding ingredient, attractive in price, imparting excellent properties both to uncured and cured stocks. It is used not only to lower volume cost, but also to lower processing costs and to reduce seconds or defective goods."

"The Condensed Chemical Dictionary." Fifth Edition. Revised by Arthur and Elizabeth Rose. Reinhold Publishing Corp., New York, N. Y. Cloth cover, 6 by 9 inches, 1,220 pages. Price, $12.50.

Now containing more than 30,000 entries, this latest edition of "The Condensed Chemical Dictionary" represents a considerable expansion over the fourth edition published six years ago and is believed by its publishers to be the largest and most complete work of its kind in existence. Such information as chemical and physical properties, derivation, method of purification, manufacturers, grades, applications, and shipping regulations and types of containers required are reported for chemicals and other industrial and commercial raw materials. Trade names have been included in the main body of the volume. The appendix contains a numerical reference list of manufacturers, an alphabetical list of manufacturers, information on the transportation of explosives and other dangerous articles, and a summary of safety information warnings and labels. The dictionary is thumb-indexed and printed in large, readable type.

"Latex—Natural and Synthetic." Philip G. Cook. Reinhold Publishing Corp., New York, N. Y. Cloth cover, 4¾ by 7 inches, 238 pages. Price, $3.50.

This small book, intended for newcomers to the field, depicts how both natural and synthetic types of rubber latex are produced, modified, and converted into useful products.

Mr. Cook, technical superintendent of General Latex & Chemical Corp., has divided his text into the following chapter headings: development of latex to its present form; latex production and importation; testing of latex prior to use; vulcanization of latex; materials affecting liquid properties in compounding; materials affecting film properties in compounding; processing and testing of compounds; synthetic rubber latices; rubber-plastic latices; latex unsupported films or filaments; and latex coatings, binders, and saturants.

Chapters 11 and 12 on latex products should be of particular interest to young technical men entering the rubber industry. A broad survey of these products and their technology of manufacture is presented in these chapters.

The author has assumed a certain technical understanding on the part of his reader and has kept explanations of terminology down to a minimum.

NEW PUBLICATIONS

Publications of Harwick Standard Chemical Co., Akron, O.:

"Thixon Primer PA-P." Bulletin #03-162-0-10-56. 2 pages. The properties and application of this primer to be used in conjunction with Thixon PA-B secondary cement for vulcanization bonding of polyacrylate stocks to metal are discussed on this data sheet.

"Thixon PA-B." Bulletin #03-165-0-10-56. 2 pages. The properties and application of this rubber-to-metal bonding adhesive for the vulcanization bonding of polyacrylate stocks to primed metals are given in this publication.

"Polycizers." Bulletin #07-75-2-10-56. 4 pages. The chemical and physical properties of the company's PVC plasticizers—Polycizers 162 (DOP), 332 (DOA), 532 (ODA), 562 (ODP), 632 (DDA), and 662 (DDP)—are reported in this publication, together with their viscosity characteristics in Geon 121 resin, and their use in wire and cable.

"HSC Silicone Emulsions." Bulletin #11-35-1-10-56. 2 pages. Properties, dilution recommendations, uses, stability, and compatibility of the company's HSC-35, -362, and -515 silicone emulsions are discussed in this data sheet. The emulsions are said to be effective release agents for all types of rubber stocks and vinyl compounds in molds, on mandrels, and in lead sheath operations.

"Stan-Tone PEC Polyester Paste Colors." Bulletin #02-160-0-9-56. 1 page. Twelve polyester vehicle-dispersed pigments (manufactured by Sinclair & Valentine Co.) are listed and described briefly on this data sheet.

"Neoprene Cable Jacket Compounds." B. A. Wilkes and T. D. Bolt. Technical Service Laboratory Bulletin No. GD-17. Godfrey L. Cabot, Inc., Cambridge, Mass. 3 pages. The use of Cabot's Pelletex SRF black or Sterling V GPF black for neoprene heavy-duty cable jacket compounds to meet the requirements of ASTM D-752-54T is discussed here. Formulations and postcure test data are given.

"Tech-Book Facts," The Goodyear Tire & Rubber Co., Inc., chemical division, Akron, O.:

"Properties: Plio-Tuf P100 for Injection Molding." 56-65A. 2 pages. The electrical properties, chemical resistance, and effect of recycling of Plio-Tuf P100, a modified high styrene resin exhibiting high impact strength, high heat distortion point, and flow characteristics said to be ideal for injection molding, are contained in this data sheet. Typical physical properties of Plio-Tuf P100 injection molded specimens are also given.

"Injection Molding of Plio-Tuf P100." 56-67. 2 pages. The equipment and conditions required for injection molding of Plio-Tuf P100 are described here, together with typical problems encountered and case histories.

"Finishing and Lacquering of Plio-Tuf P100." 56-68. 1 page. Discussed in this publication are the finishing and lacquering operations suitable for extruded or injection molded Plio-Tuf P100.

"Effect of Chemicals on Plio-Tuf P100." 56-151. 1 page. The physical effects on Plio-Tuf P100 after seven-day immersions in a wide variety of chemical reagents are summarized here.

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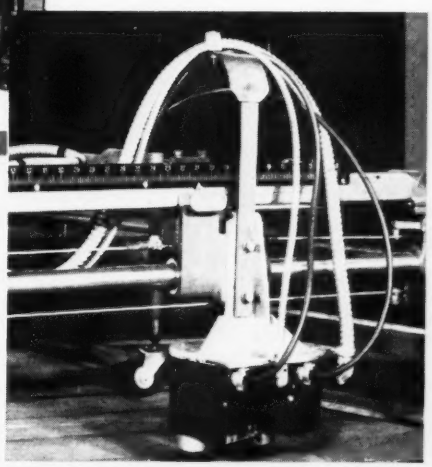

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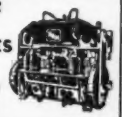

Publications of Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.:

"Designing with Plaskon Plastics and Resins." 4 pages. The uses, physical and electrical properties, chemical resistance, and special molding advantages of Plaskon thermosetting molding compounds and polyester resins are reported in this illustrated folder.

"Plaskon Resins for Shell Molding." 32 pages. The shell molding process for casting metals is dealt with in this illustrated booklet, with emphasis on the foundryman's problems. Representative types of shell molding machinery, typical pattern designs, and recommended design techniques are depicted. Plaskon phenolic resins for shell molding are described.

Publications of Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

"Polylite." F. L. Holbrook. Bulletin No. 212. 6 pages. The physical properties and use of Polylite, a strong, general-purpose antioxidant and stabilizer having minimum discoloration and staining properties in SBR, natural rubber, and latex appear in this bulletin. Recipes and postcure test data are included.

"Marvinol VR-10." Bulletin No. 4. 12 pages. The physical properties and processing of Marvinol VR-10, a straight polyvinyl chloride resin for the slush molding, rotational molding, foam formulation, spread coating, and hot and cold dip manufacture of a variety of plastisol goods and novelties are discussed in this illustrated booklet. Recipes and test data are also given.

Publications of E. I. du Pont de Nemours & Co., Inc., elastomers division, Wilmington, Del.:

"Neoprene Notebook." No. 72. 8 pages. This illustrated issue of the Notebook includes articles on simulated service tests for developing specifications for the purchase of rubber products, the use of neoprene bulk containers for shipping resin, the application of liquid neoprene as a maintenance coating to prevent corrosion of metal automobile parts, and a sparkproof conductive flooring of a neoprene composition.

"Facts about Hypalon." No. 5. 2 pages. The weathering resistance of Hypalon, the use of Hypalon hose for acid unloading, and the effectiveness of a Hypalon-coated pickling acid storage vat are discussed in this illustrated publication.

Publications of B. F. Goodrich Co., Akron, O.:

"Dock Loading Hose." Bulletin 4100. 4 pages. Specifications and cross-sections of the company's nylon cord and steel-wire-reinforced hose for dock loading applications are given in these data sheets.

"Oil Hose Fittings." Bulletin 4120. 2 pages. Contained on this data sheet are specifications and cross-sections of Goodrich's oil hose nipples and flanges and molded Flexseal hose ends.

"OrganoFunctional Silanes." SF-1055. Union Carbide & Carbon Corp., silicones division, New York, N. Y. 20 pages. A new class of monomeric silicon chemical intermediates, these silanes can be reacted with organic chemicals because functional groups have been added to the conventional organosilanes. This booklet reports amine, silane, and carbethoxy-ethoxy silane reactions and points out possible end-products, such as lubricants, emulsifiers, anti-static agents, synthetic resins, and flame retarding materials.

"1957 Guide to Improved Packaging." Bakelite Co., New York, N. Y. 12 pages. The company's polyethylene, styrene, vinyl, and phenolic plastics for packaging use are discussed in this illustrated booklet.

"The House of Today." B. F. Goodrich Chemical Co., Cleveland, O. Applications of the firm's flexible, rigid, and foamed Geon vinyls in the modern home are described and illustrated in this brochure.

"1957 Guide to Dow Corning Silicone Products." Dow Corning Corp., Midland, Mich. 12 pages. Almost 150 commercially available silicone products are described in the company's latest catalog, grouped by usage. Photographs of applications are included, as well as illustrative charts, tables, and graphs.

Publications of American Society for Testing Materials, Philadelphia, Pa.:

"Glossary of Terms Relating to Rubber and Rubber-Like Materials." ASTM Special Technical Publlcation No. 184. 126 pages. Price, $3. The body of this glossary contains more than 2,000 terms and their definitions. An appendix has the trade names of apparatus and chemicals related to the field of rubber. It was prepared by subcommittee 8 of Committee D-11 on Rubber; this subcommittee was headed by Harry L. Fisher, formerly of the University of Southern California.

"Symposium on Speed of Testing of Non-Metallic Materials." ASTM Special Technical Publication 185. 86 pages. Price, $2.50. This is a compilation of eight papers on the effect of testing speed on non-metallic materials, including one on the effect of speed of testing on the tension test of elastomers and hard rubber. The papers cover testing from very slow to very rapid rates. The book is illustrated with graphs, charts, and photographs and has extensive bibliographies.

"Double-Coated Tapes." Johns-Manville Dutch Brand Division, Chicago, Ill. 4 pages. Specifications and use of the firm's double-coated Paper Tape No. 358 and Cloth Tape No. 351 are reported in this illustrated sales brochure.

"Trantex Vinyl Tapes." 8 pages. The company's vinyl tapes for covering and protecting pipes, valves, frames, racks, and metal surfaces against corrosion above or below ground are discussed in this illustrated booklet.

"1957 Verified Directory of Manufacturers' Representatives." Manufacturers' Agent Publishing Co., New York, N. Y. 195 pages. Price, $20. This directory lists 14,500 manufacturers' domestic and export representatives in the United States, its Territories, and Canada and gives the principal products carried by each and the trading area covered. Commission scales for various products are suggested as an aid to sales executives.

"Dust Control for Industry." Bulletin No. 922. Pangborn Corp., Hagerstown, Md. 16 pages. The company's dust control equipment and accessories are described and illustrated in this booklet.

"Norelco Electron Microscopes." North American Philips Co., Inc., Mount Vernon, N. Y. 12 pages. The specifications and use of the company's EM-100B and EM-75 electron microscopes are given in this illustrated booklet.

"Colloidal Dispersions for High-Temperature Lubrication." Bulletin No. 423. Acheson Colloids Co., Port Huron, Mich. 6 pages. The company's 'dag' colloidal graphite and molybdenum disulfide dispersions for high temperature lubrication in a variety of industries are described in this folder, and specific applications detailed and illustrated.

"Silicone Lubricants." Reference No. 6-101. Dow Corning Corp., Midland, Mich. 8 pages. Physical properties and uses of the company's commercially available silicone oils and greases are reported in this illustrated brochure. High-speed, high-temperature ball-bearing industrial problems are dealt with.

Monitor A

(*Continued from page 613*)

copper and iron, preventing breakdown and discoloration. This sequestrant, moreover, will prevent coagulation by heavy metals and will also increase adhesion to cement and ferrous metal surfaces, while protecting against corrosion.

Light amber in color, with a very slight aromatic odor, Monitor A has a specific gravity of 1.2, a moisture content of 10% by weight, no flash point, and will polymerize on heating at 150° C. It is said to be compatible with natural and synthetic water-soluble gums, resins, glues, and thickeners and will not cause swelling of rubber. It is stable in the presence of reducing agents, mild oxidizing agents, and on prolonged boiling in acid and basic solutions.

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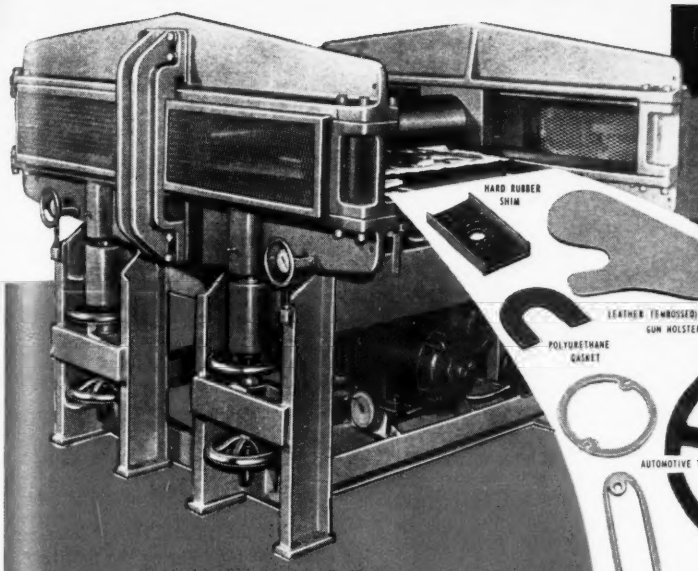

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MARKET REVIEWS

Natural Rubber

Prices on the natural rubber market during the November 16-December 15 period moved up again as the international situation remained uncertain and clearance of the Suez Canal still seemed a long way off. Spot RSS 1 gained 2¢ a pound over the period. Trading on the New York Commodity Exchange increased in volume, with 50,040 tons being exchanged in all three contracts.

Other factors contributing to the rise included a heavy Continental offtake, better-than-average Russian buying, and the General Services Administration announcement that there would be no change in the procedure for replacing rotation rubber in the government stockpile. The brief New York waterfront strike was apparently ignored by consumers. Improved prospects for peace in the Middle East caused easier prices toward period-end.

January outlook cannot be predicted with assurance. Trade sources, however, speculate that the international situation, relatively calm as of this writing, is still in a state of flux, making for caution on the part of consumers.

Statistically, week-end closing Commodity Exchange future prices for all three rubber contracts were as follows:

R.S.S. #1 Contract

	Nov. 16	Nov. 23	Nov. 30	Dec. 7	Dec. 14
Dec.	35.30	36.10	36.90	37.50	36.30
Total weekly sales, tons	410	780	1,080	250	160

Rubber Standard Contract

	Nov. 16	Nov. 23	Nov. 30	Dec. 7	Dec. 14
Dec. 1957	35.05	35.85	36.90	37.50	36.30
Mar.	34.20	35.60	37.10	37.55	37.00
May	33.85	35.20	37.00	37.05	36.65
July	33.45	34.75	36.60	36.60	36.25
Sept.	33.05	34.30	36.10	36.10	35.85
Nov. 1958	32.55	33.80	35.60	35.65	35.35
Jan.			35.10	35.25	34.85
Total weekly sales, tons	0	130	30	0	0

Rex Contract

	Nov. 16	Nov. 23	Nov. 30	Dec. 7	Dec. 14
Nov. 1957	35.05	35.95			
Jan.	34.75	35.80	37.40	37.65	36.95
Mar.	34.45	35.60	37.10	37.55	37.00
May	34.05	35.35	37.00	37.05	36.65
July	33.65	34.95	36.60	36.60	36.25
Sept.	33.25	34.50	36.10	36.10	35.85
Nov. 1958	32.75	34.00	35.60	35.65	35.35
Jan.			35.10	35.25	34.85
Total weekly sales tons	8,570	7,340	17,680	11,460	10,080

On the physical market, RSS 1 began the November 16-December 15 period at 34.75¢ a pound, rose to a period high of 37.50¢ on December 3, and ended the period at 36.75¢. Average November monthly spot prices for representative grades, as reported by The Rubber Trade Association of N. Y., Inc., were as follows: RSS #1, 35.11¢; RSS #3, 34.70¢; #3 Amber Blankets, 28.45¢; and Flat Bark, 22.97¢. There were 19 trading days during the month. For the first half of November, the #1 grade averaged 36.79¢.

New York Physical Market
Week-End Closing Prices

	Nov. 16	Nov. 23	Nov. 30	Dec. 7	Dec. 14
R.S.S.: #1	34.75	35.75	37.00	37.25	36.75
2	34.50	35.50	36.75	37.13	36.63
3	34.38	35.38	36.63	37.00	36.50
Pale Crepe #1 Thick	43.50	45.75	47.50	47.50	47.00
Thin	43.50	44.75	45.50	45.50	45.00
#3 Amber Blankets	28.25	29.00	29.75	30.25	30.50
Thin Brown Crepe	27.50	28.25	29.00	29.50	30.25
Standard Flat Bark	22.75	23.50	24.00	24.25	23.75

Synthetic Rubber

Major producers of styrene will cut the price of this component of SBR from 16 to 12¢ a pound, effective July. Trade sources indicate the impending reduction resulted from a behind-the-scenes conflict between users and producers of styrene in which the users expressed their reluctance to pay the going price of the material, particularly since it is in abundant supply. Not too long ago The Firestone Tire & Rubber Co. announced it would build a 100-million-pound styrene plant for its own use. Rather than risk the loss of their market, styrene producers agreed to cut prices. The lower levels are expected to discourage rubber producers from building major styrene plants, at least in the near future.

Consumers of SBR, however, are not hoping to benefit from the lower styrene price. The cost of butadiene, the second component of SBR, is still high and expected to go even higher in 1957, probably resulting in an increase in the price of some grades of SBR this year.

Whatever the cost to consumers, the heavy demand for SBR will continue unabated, both at home and abroad. It is anticipated that exports of all types of synthetic rubber during 1957 will reach 150,000 long tons, compared to the estimated 115,000 tons shipped abroad last year.

Additional new grades of SBR may be announced this year. These grades will certainly include more oil-extended rubbers with improved non-staining and processing characteristics.

The year just passed will see synthetic rubber output in this country rise above the record one-million-ton mark, according to Harvey S. Firestone, Jr., chairman of Firestone. The estimate was based on the 902,000 tons of synthetic rubber produced during the first 10 months of 1956, the latest figures available. Production of man-made rubber hit 970,000 tons in 1955.

Synthetic rubber demand during the last quarter of 1956 was about as high as expected, with the last month of the year showing the greatest sales volume. Demand in October and November was lower than expected.

Latex

Activity in the natural rubber latex market continued high during the first half of the November 16-December 15 period, but waned later. The higher business level was a direct result of the fear that political developments in the Middle East and elsewhere might take a turn for the worse. Buying faded with the apparent satisfaction of consumers' near requirements and the seeming relaxation of international tensions.

The recent advance in the premium for natural latex has been halted, and with the possibility of supply again exceeding demand before long, a break in the premium level is not unlikely.

Although trade reports on activity in the synthetic latex market are, as usual, sparse, demand for the latices was believed to have been good during the November 16-December 15 period.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b. rail tank cars, ranged during the period from 44 to 49¢ per pound solids. Prices of synthetic latices remained steady at 26-32.3¢, SBR; 37-47¢, neoprene; and 46-54¢ a pound, N-type.

Final September and preliminary October domestic statistics for all latices were reported by the United States Department of Commerce as follows:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Sept.	0	2,790	6,233	15,403
Oct.	0	....	7,297	11,849
SBR				
Sept.	5,651	72	4,937	6,625
Oct.	6,122	..	5,884	5,422
Neoprene				
Sept.	1,180	0	692	1,328
Oct.	908	0	773	1,203
Nitrile				
Sept.	938	0	699	1,523
Oct.	1,183	0	480	1,195

Reclaimed Rubber

The reclaimed rubber industry did not show the expected volume increase during the November 16-December 15 period, according to trade sources. Difficulty in getting the automotive industry into full pro-

CYANAMID RUBBER
Chem Lines

NO. 8
OF A SERIES

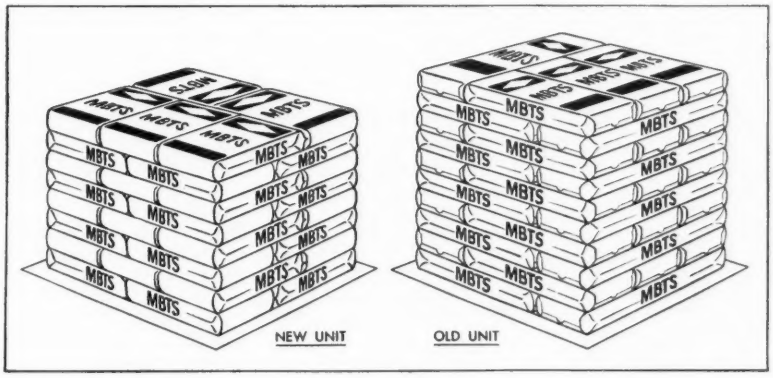
Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

New Packaging for MBTS Saves 20% Space

New equipment for the production of MBTS, as reported in the July issue of Rubber Chem Lines, has now been in operation for over six months. The high expectations regarding the effect of plant modernization on product quality have been fully justified. Currently produced MBTS is remarkably uniform in particle size and free of even the small amount of oversized particles normally associated with a microground product. Dedusting and lubricating additives are well distributed. Ash is low and any magnetic iron particles are removed by electromagnet separation. The range of purity, or real MBTS content, is high and the amount of free MBT is low. The net result is a product which physically and chemically is designed and manufactured to the highest performance standards possible for a powdered accelerator.

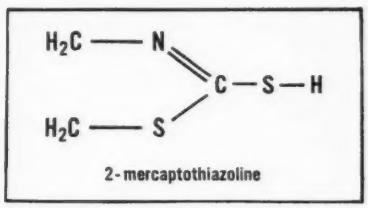
Included in the new equipment is a vacuum bag packer capable of packing fifty pounds of fluffy, free-flowing MBTS into a considerably smaller bag than was formerly used. In effect, this machine "densifies" the freshly packed product to the same degree produced by normal stacking in storage. This densification in no way interferes with the free-flowing characteristics of the product, but merely eliminates the wasted bag capacity previously evident in shipped material.

Illustrating the space-saving ability of this new package in warehouse storage, the schematic drawing shows unit loads of 2000 pounds each. The new bags are unitized in a pattern of five-bag layers, eight layers high. A corresponding unit load using the old bags required ten layers of four bags each. Since the base dimensions (which conform to a standard pallet size) remain unchanged, the effective reduction is in the height of the unit. The resultant cubic space reduction is approximately 20%. This should be of interest to any user of MBTS who has a warehouse storage space problem.



2-MT—A New Addition
(2-mercaptothiazoline)

To its wide range of accelerators for the rubber industry, Cyanamid has recently added 2-MT, a fast-curing accelerator active above 250°F. The chemical formula is:



2-mercaptothiazoline

As a special purpose accelerator, 2-MT should find applications where its particular properties are superior to the types currently available. For example, it is most effective in natural rubber channel black tread or carcass stocks. 2-MT offers good physical properties with high modulus, exceptional flex-cracking resistance and good heat aging characteristics.

In addition to its value in natural rubber stocks, 2-MT has proved very effective in high-grade cold GR-S camelback stocks. The excellent physical properties imparted to the camelback stock by the use of 2-MT result in greatly improved mileage.

Latex compounding offers another application for 2-MT. When used in combination with ultra accelerators, 2-MT has shown outstanding heat resistance. This property is naturally important for applications where the product is subjected to heat, such as the backing for rugs which are subsequently bleached, dyed and dried, and in latex threads which are used in garments ultimately exposed to laundering many times.

More information on this new accelerator is available to those interested, and samples will be sent on request. Your Cyanamid representative will be glad to help you in determining what areas of your rubber compounding problems 2-MT can best serve.

duction was cited as the cause of the setback. Improvement during January, however, was anticipated.

Exports of reclaimed rubber in August amounted to 2,410,973 pounds, worth $246,442, as compared with 2,135,508 pounds, valued at $202,445, exported in July, according to the Bureau of the Census, United States Department of Commerce. Imports of reclaimed rubber in August totaled 293,996 pounds, valued at $17,798, all originating from the United Kingdom. No reclaimed rubber import figures were available for July.

Prices of reclaimed rubber during the period were unchanged.

RECLAIMED RUBBER PRICES

	Lb.
Whole tire: first line	$0.105
Fourth line	.0925
Inner tube: black	.15
Red	.21
Butyl	.14
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Scrap Rubber

Trading in the scrap rubber market during the November 16-December 15 period continued dull, crowning a year which was "one of continuously diminishing returns," according to Samuel Tanney, president, Scrap Rubber & Plastics Institute, National Association of Waste Material Dealers. Mixed auto tires dropped about $3 a ton over the year, an example cited by Mr. Tanney in pointing out the typical difficulties facing the industry.

Scrap rubber exports rose to 4,524,906 pounds, valued at $149,635, in August from the 3,941,883 pounds, worth $107,573, shipped abroad in July, according to statistics released by the Bureau of the Census, U. S. Department of Commerce.

Imports of scrap rubber during August totaled 1,924,743 pounds, valued at $66,098, compared to 2,287,881 pounds, worth $237,438, imported in July.

Period-end prices of scrap rubber grades, unchanged from last month follow:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$10.00/13.50	$13.50/14.00
S.A.G. auto tires	Nom.	Nom.
Truck tires	Nom.	Nom.
Peelings, No. 1	40.00	40.00
2	Nom.	Nom.
3	16.00	17.00
Tire buffing	Nom.	Nom.
	(¢ per Lb.)	
Auto tubes, mixed	2.75	2.75
Black	5.75	5.75
Butyl	3.75	3.75
Red	6.75	6.75

Industrial Fabrics

New buying in the industrial fabrics market lagged during the November 16-December 15 period, with little new or forward buying taking place, and prices generally tending to ease slightly as concessions were made on limited orders. Trade sources expected a revival of buying interest during January in wide fabrics, cotton ducks, and other industrial goods.

Period-end prices of cotton fabrics are:

INDUSTRIAL FABRICS

Drills		
59-inch 1.85 yd.	yd.	$0.375
2.25-yd		.325
Ducks		
38-inch 1.78-yd. S.F.	yd.	nom.
2.00-yd. D.F.		.3175
51.5-inch, 1.35-yd. S.F.		nom.
Hose and belting		.69
Osnaburgs		
40-inch 2.11-yd.	yd.	.25
3.65-yd.		.16
Raincoat Fabrics		
Printcloth, 38½-in., 64x60, 5.35-yd.	yd.	.14
6.25 yd.		.12
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.23
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	yd.	.73
11.65-oz./sq. yd. S.		.64
10.80-oz./sq. yd. S.		.6875
8.9-oz./sq. yd. S.		.70
Other Fabrics		
Headlining, 59-in., 1.65-yd., 2-ply	yd.	.41
64-inch, 1.25-yd., 2-ply		.59
Sateens, 53-inch, 1.32-yd.		.575
58-inch, 1.21-yd.		.625

Rayon

Total calculated production of rayon and acetate yarn during November was 61,100,000 pounds, of which 34,000,000 pounds were regular-tenacity yarn, and 27,100,000 pounds were high-tenacity rayon yarn. October production had been: total, 61,800,000 pounds; regular-tenacity, 31,800,000 pounds; and high-tenacity, 30,000,000 pounds.

Domestic shipments for November totaled 59,200,000 pounds, consisting of 33,900,000 pounds of regular-tenacity yarn and 25,300,000 pounds of high-tenacity rayon yarn. October shipments had been: total, 63,100,000 pounds; regular-tenacity, 33,900,000 pounds; and high-tenacity, 29,200,000 pounds.

Total end-of-November stocks were 62,100,000 pounds, of which 48,200,000 pounds were regular-tenacity yarn, and 13,900,000 pounds were high-tenacity rayon yarn. End-of-October stocks had been: total, 61,100,000 pounds; regular-tenacity, 48,800,000 pounds; and high-tenacity, 12,300,000 pounds.

As of this writing, current prices of tire yarns and fabrics are as follows:

RAYON PRICES

Tire Yarns	
High-Tenacity	
1100/ 480	$0.59/$0.64
1100/ 490	.59/ .64
1150/ 490	.64
1165/ 480	.65
1230/ 490	.64
1650/ 720	.55/ .61
1650/ 980	.55/ .61
1875/ 980	.61
2200/ 960	.55/ .60
2200/ 980	$0.55/$0.60
2200/1466	.64
4400/2934	.60
Super-High-Tenacity	
1650/ 720	.58
1900/ 720	.58
Tire Fabrics	
1100/490/2	.77
1650/980/2	.725
2200/980/2	.715

Groups Celebrate

(*Continued from page 581*)

about 100 supplier companies.

Retiring chairman of the Group, G. H. Provost, United States Rubber Co., thanked the 1956 officers, directors, and committee members for their help with the Group's activities during the year. He then introduced the 1957 chairman, H. J. Due, St. Joseph Lead Co.; the vice chairman, C. V. Lundberg, Bell Telephone Laboratories; secretary-treasurer, R. G. Seaman, RUBBER WORLD; and sergeant-at-arms, N. Cooperman, National Lead Co.

New members of the executive committee serving for three-year terms are as follows: R. Emmett, Columbian Carbon Co.; M. W. Gall, Luzerne Rubber Co.; L. J. Radi, R-B-H Dispersions; and Ralph DeTurk, Whittaker, Clark & Daniels.

Shell Speaker at Tlargi

A talk on non-staining extenders for SBR polymers was given by R. J. Reynolds, Shell Development Corp., at the technical session of the November 13 meeting of The Los Angeles Rubber Group, Inc., at the Hotel Biltmore, Los Angeles, Calif.

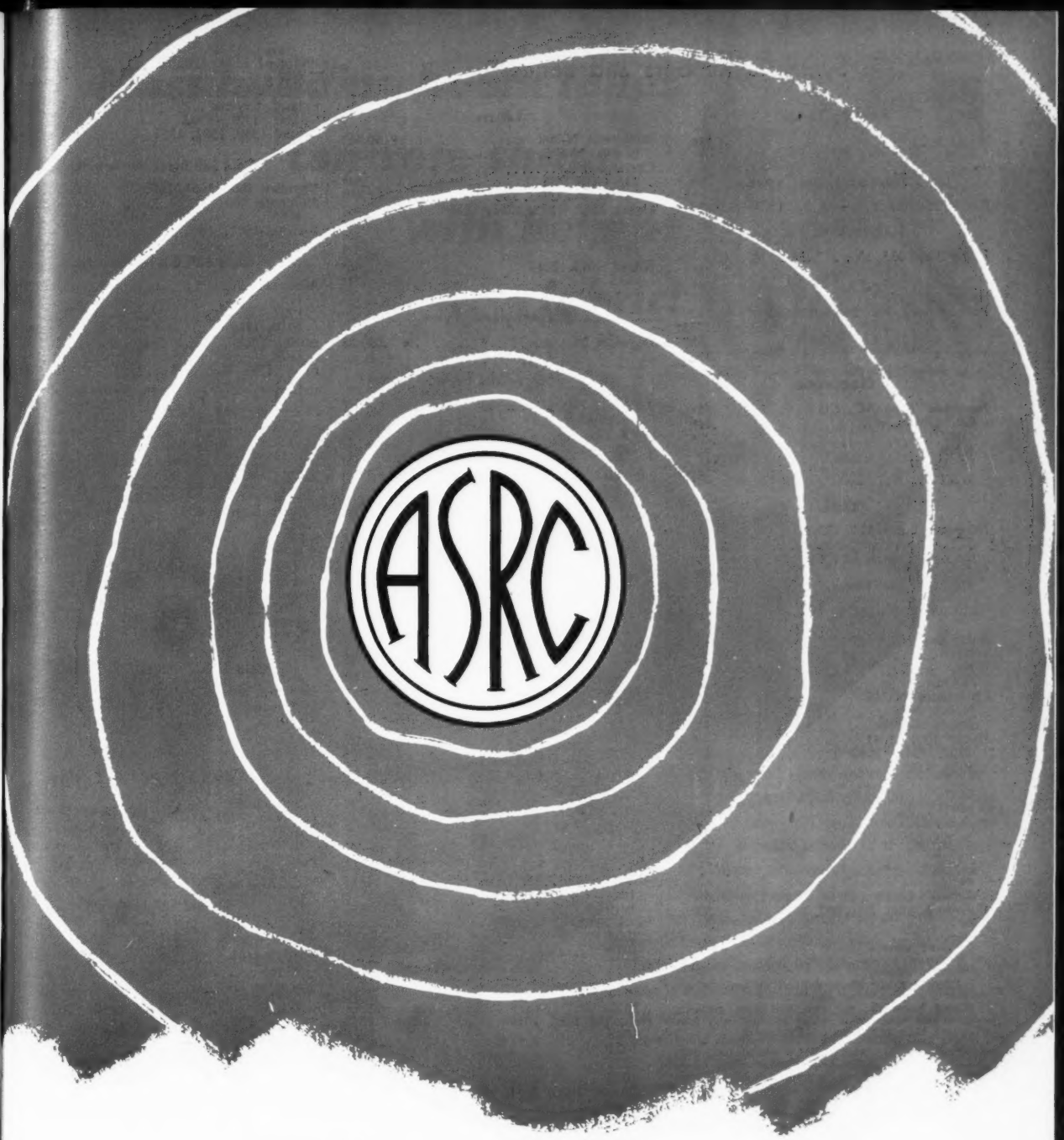
In his discussion, Dr. Reynolds said that the discoloration of any given petroleum product was in itself no criterion of the staining results to be obtained in a vulcanizate made from a SBR polymer containing the particular product as an extender oil, provided the product was acceptable as an extender oil for SBR. Data comparing a new Shell non-staining extender with two others on the market were presented.

The 293 members and guests attending the evening dinner saw motion pictures of the fifth running of the Pan American stock car races. The commentary was by Ray Crawford, winner of the event.

The Group will meet at the Biltmore Hotel instead of the Hotel Statler in '57.

Nucleonics Conference

The second annual Industrial Nuclear Technology Conference will be held at the Museum of Science & Industry, Chicago, Ill., May 14-16, under the sponsorship of the Armour Research Foundation of Illinois Institute of Technology and *Nucleonics Magazine*. Information may be obtained from Dr. Leonard Reiffel, Armour Research Foundation, Chicago 16, Ill.



...an expanding symbol of quality and service in synthetic rubber!

Current Polymers

Cold	Class
ASRC 1500	Staining
ASRC 1502	Non-staining
Cold Oil	
ASRC 1703	Non-staining
ASRC 1708	Non-staining
Hot	
ASRC 1000	Staining
ASRC 1001	Slightly staining
ASRC 1004	Staining
ASRC 1006	Non-staining

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Isobutylene Types

Enjay Butyl 035, 150, 215, 217, 218, 325	.23[a]
165, 265, 267, 268, 365	.24[a]
Hycar 2202	.65[c]
Polysar Butyl 100, 200, 300, 400	.245[c]
101	.2775[a]
301	.255[c]
Vistanex	.45[a]

Neoprene

Neoprene Type AC, CG	.55[a]
GN, GN-A, WX	.41[a]
GRT, S	.42[a]
KNR	.75[a]
W, WHV	.39[a]
WRT	.45[a]

Latices

Neoprene Latex 571, 842-A	.37[a]
572	.39[a]
60, 601-A	.40[a]
735, 736	.38[a]
950	.47[a]

Nitrile Types

Butaprene NAA	.54[a]
NF	.49[a]
NL	.50[a]
NXM	.58[a]
Chemigum N1NS	.64[b]
N3NS, N5	.58[b]
N6, N-6B, N7	.50[b]
Hycar 1001, 1041	.58[c]
1002, 1042, 1043	.50[c]
1014, 1312	.60[c]
1411	.62[c]
1432	.59[c]
1441	.64[c]
Paracril AJ	.485[c]
B, BJ, BJLT, BLT	.50[c]
C, CLT	.58[c]
CV	.59[c]
D	.65[c]
18-80	.60[c]
Polysar Krynac 800, 802, 803	.50[c]
801	.58[c]

Latices

Butaprene N-300	$0.46[b]
N-400, N-401	.54[b]
Chemigum	.49[b]
235 CHS, 236	.54[b]
245 B, 245 CHS, 246	.46[b]
Hycar 1512, 1552, 1562, 1577	.46[c]
1551, 1561	.54[c]
1571	.59[c]
1572	.51[c]
Nitrex 2612, 2614	.46[a]
2615	.51[a]

Polyethylene Type

Hypalon 20 *lb.*	.85/.88

Polysulfide Types

Thiokol LP-2, -3, -32, -33	.96[a]
-8, -38	1.25[a]
PR-1	.95[a]
Type-A	.47[a]
FA	.69[a]
ST	1.00[a]

Latices

Thiokol Latex (dry wt.)	
Type MF	.85[a]
MX	.70[a]
WD-2	.92[a]
-5	.95[a]
-6, -7	.70[a]

Silicone Types

GE (compounded)	2.25[a]/4.10[a]
Silicone gum (not compounded)	3.85[a]/4.90[a]
Silastic (compounded)	1.95[b]/3.65[b]
(Partly compounded)	3.38[b]/3.90[b]
(Uncompounded)	3.85[b]/4.50[b]
Union Carbide (compounds)	2.35[b]/3.20[b]
(Gums)	3.85[b]/4.25[b]

Styrene Types†

Hot SBR‡

Ameripol 1000, 1001, 1006	.241[c]
ASRC 1000, 1001, 1004, 1006	.241[c]
1018	.276[c]
1019	.265[c]
FR-S 1000, 1001, 1004, 1006	.241[c]
1009	.2475[c]
1010	.26[c]
1012	.2425[c]
1013	.25[c]
1014	.281[c]
1015	.291[c]
Naugapol 1016, 1019	.265[b]
1018	.27[b]
1021	.30[b]
1022	.28[b]
1023	.285[b]
Philprene 1000, 1001, 1006	.241[b]
1009	.255[b]
1018	.27[b]
1019	.265[b]
Plioflex 1006	.241[c]
Polysar Kryflex 200, S, S-50	.241[c]
SS-250	.30[c]
S-X-371	.255[c]
S-1000, -1001, -1006, -1013	.23[a]
-1002, -1011	.2325[a]
Synpol 1000, 1001, 1006, 1061	.241[b]
1002	.2435[b]
1007, 1012	.2425[b]
1009	.2475[b]
1013	.25[b]

Hot SBR Black Masterbatch

S-1100	.185[a]

Cold SBR

Ameripol 1500, 1501, 1502	.241[c]
ASRC 1500, 1502	.241[c]
1503	.2625[c]
Copo 1500, 1502	.241[c]
FR-S 1500, 1502	.241[c]
Naugapol 1503	.2625[b]
1504	.295[b]
Philprene 1500, 1502	$0.241[b]
1503	.2625[b]
Plioflex 1500, 1502	.241[c]
Polysar Krylene	.241[c]
S-1500, -1501, -1502	.23[b]
Synpol 1500, 1502, 1551	.241[b]

Cold SBR Black Masterbatch

Baytown 1600, 1601, 1602	.176[a]
Philprene 1601	.191[b]
1605	.188[b]
S-1600, -1601, -1602	.18[a]

Cold SBR Oil Masterbatch

Ameripol 1703	.206[c]
1705	.2035[c]
1707	.191[c]
1710, 1712	.1885[c]
ASRC 1703	.206[c]
1708	.191[c]
FR-S 1703	.206[c]
1705	.2035[c]
1712	.1885[c]
Philprene 1703	.206[b]
1706	.203[b]
1708	.191[b]
1712	.188[b]
Plioflex 1703, 1773	.206[c]
1710, 1712	.1885[c]
1778	.191[c]
Polysar Krynol 651	.1885[c]
652	.191[c]
S-1703	.195[a]
-1706	.1925[a]
-1707	.18[a]
-1709, -1712	.1775[a]
Synpol 1703	.2075[b]
1707	.1925[b]
1708	.191[b]
1711	.19[b]

Cold SBR Oil-Black Masterbatch

Baytown 1801	.16[a]
Philprene 1803	.173[b]
S-1801	.165[a]

Hot SBR Latices

FR-S 2000, 2001, 2006	.26[a]
2002	.285[a]
2003, 2004	.295[a]
Naugatex 2000, 2001, 2006	.263[a]
2002	.288[a]
2005	.30[a]
S-2000	.2275[a]
2006	.215[a]

Cold SBR Latices

FR-S 2105	.31[a]
Copo 2101	.28[a]
2102, 2105	.31[a]
X-765	.29[a]
Naugatex 2101	.285[a]
2105	.312[a]
X-767	.323[a]
Pliolite Latex 2101, X765	.30[a]
2105	.32[a]
S-2101	.225[a]

Cold BR Latex§

Pliolite Latex 2104	.32[c]

[a] Freight prepaid.
[b] Minimum freight allowed.
[c] Freight prepaid.

Prices are per pound carload or tank-car dry weight unless otherwise specified.

‡Listed below are the new SBR type synthetic rubbers and latices trade names and the chief sales offices of their producers or distributors.

Ameripol —Goodrich-Gulf Chemicals, Inc., 3121 Euclid Ave., Cleveland 15, O.

ASRC —American Synthetic Rubber Corp., 500 Fifth Ave., New York 36, N. Y.

Baytown —United Rubber & Chemical Co., Baytown, Tex. (producer); United Carbon Co., Inc., Charleston 27, W. Va. (distributor).

Butaprene, FR-S —Firestone Tire & Rubber Co., Synthetic Rubber Division, 381 Wilbeth Rd., Akron 1, O.

Copo —Copolymer Rubber & Chemical Corp., P. O. Box 1029, Baton Rouge 1, La.

Naugapol, Naugatex —Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

Philprene —Phillips Chemical Co., Rubber Chemicals Division, 318 Water St., Akron 8, O.

Plioflex —Goodyear Tire & Rubber Co., Chemical Division, Akron 16, O.

Pliolite Latex—Goodyear Tire & Rubber Co., Chemical Division. Also distributed by General Latex & Chemical Corp., 666 Main St., Cambridge 39, Mass.

Polysar —Polymer Corp., Ltd., Sarnia, Ont., Canada (producer); H. Muehlstein & Co., Inc., 60 E. 42nd St., New York 17, N. Y. (distributor).

S- —Shell Chemical Corp., Synthetic Rubber Sales Division, 30 W. 50th St., New York 20, N. Y.

Synpol —Texas-U. S. Chemical Co., Port Neches, Tex. (producer); Naugatuck Chemical (distributor).

‡SBR —Styrene butadiene rubber.

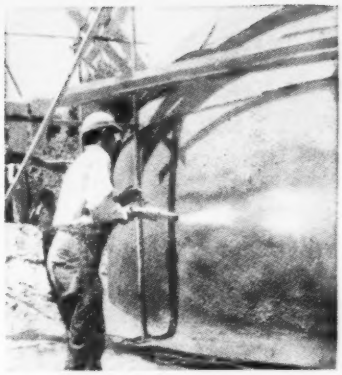
§BR —Butadiene rubber.

Borden PVC Plant Opens

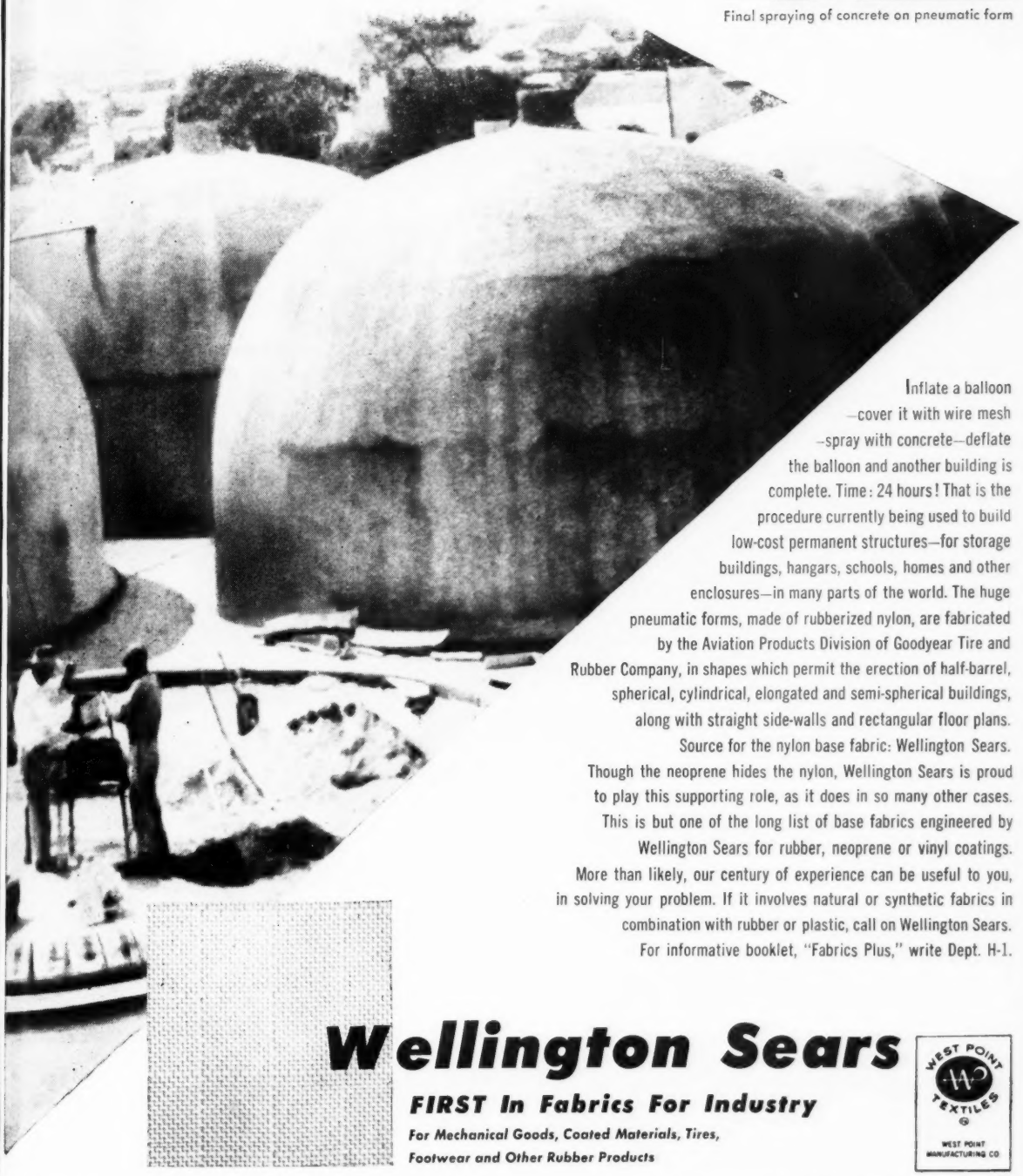
The first polyvinyl chloride resin plant of Borden Co., New York, N. Y., an almost fully automated 12,000,000-pound-a-year facility at Leominster, Mass., has begun operations. Construction that will triple the unit's capacity before the end of the year is continuing.

A new laboratory-office building is also being built. In addition, the acquisition of plant and office facilities at Leominster for production of the company's line of Resinite products has been announced.

Mass building boom takes concrete shape with help of fabric!



Final spraying of concrete on pneumatic form



Inflate a balloon —cover it with wire mesh —spray with concrete—deflate the balloon and another building is complete. Time: 24 hours! That is the procedure currently being used to build low-cost permanent structures—for storage buildings, hangars, schools, homes and other enclosures—in many parts of the world. The huge pneumatic forms, made of rubberized nylon, are fabricated by the Aviation Products Division of Goodyear Tire and Rubber Company, in shapes which permit the erection of half-barrel, spherical, cylindrical, elongated and semi-spherical buildings, along with straight side-walls and rectangular floor plans. Source for the nylon base fabric: Wellington Sears. Though the neoprene hides the nylon, Wellington Sears is proud to play this supporting role, as it does in so many other cases. This is but one of the long list of base fabrics engineered by Wellington Sears for rubber, neoprene or vinyl coatings. More than likely, our century of experience can be useful to you, in solving your problem. If it involves natural or synthetic fabrics in combination with rubber or plastic, call on Wellington Sears. For informative booklet, "Fabrics Plus," write Dept. H-1.

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Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363/	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.50 /	.57
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.57 /	.58
52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	4.25	
89	lb.	1.20	
108	lb.	.91	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.50 /	.52
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.40 /	.42
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Dibs	lb.	.85	
Diesterex N	lb.	.50 /	.57
Dipac	lb.	.85	
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.62 /	.63
Du Pont	lb.	.62 /	.63
DPG (diphenylguanidine)			
Cyanamid	lb.	.52 /	.53
Monsanto	lb.	.52 /	.58
El-Sixty	lb.	.60 /	.67
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac #650	lb.	.93 /	.95
Guantal	lb.	.60 /	.67
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.42 /	.44
Du Pont	lb.	.42 /	.44
Naugatuck	lb.	.42 /	.47
-XXX, Cyanamid	lb.	.53 /	.55
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.52 /	.54
Du Pont	lb.	.52 /	.54
Naugatuck	lb.	.52 /	.57
-W Cyanamid	lb.	.57 /	.59
Merac #225	lb.	.75 /	1.05
Mertax	lb.	.53 /	.60
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
2-MT (2-mercaptothiazoline)			
Du Pont	lb.	1.00	
NOBS No. 1	lb.	.74 /	.76
Special	lb.	.79 /	.81
O-X-A-F	lb.	.53 /	.58
Pentex	lb.	1.14	
Flour	lb.	.26	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.51 /	.53
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.74 /	.81
NS	lb.	.79 /	.86
Selenacs	lb.	4.25	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Tellurac	lb.	1.21	
Tepidone	lb.	.45 /	.48
Tetrone A	lb.	1.91	
Thiofide	lb.	.52 /	.59
S	lb.	.62 /	.69
Thionex	lb.	1.14	
Thiotax	lb.	.42 /	.49
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	$1.14	
Ultex	lb.	1.00 /	$1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
ZB, ZE, ZM	lb.	.85	
Z-B-X	lb.	2.45	
Zenite	lb.	.52 /	.54
A	lb.	.62 /	.64
Special	lb.	.53 /	.55
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	

Accelerator-Activators, Inorganic

Lime, hydrated	ton	21.96	
Litharge, comml.	lb.	.175 /	.18
Eagle, sublimed	lb.	.18	
National Lead, sublimed	lb.	.18 /	.19
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.19	
National Lead	lb.	.19 /	.20
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.19 /	.20
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725/	.1825
Eagle	lb.	.20 /	.2175
National Lead	lb.	.1625/	.1725
Zinc oxide, comml.†	lb.	.145/	.1925

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.62	
Capital 170	lb.	.2175/	.2575
171	lb.	.1325/	.1725
700, 701	lb.	.16 /	.20
705, 710	lb.	.16 /	.20
800	lb.	.12/	.14
801	lb.	.1425/	.1625
802	lb.	.1475/	.1675
803	lb.	.17 /	.19
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1375/	.1775
Groco 30	lb.	.1375/	.1775
35	lb.	.1425/	.1825
Guantal	lb.	.57 /	.64
Hyfac 400	lb.	.1063/	.1325
430	lb.	.1613/	.1875
431	lb.	.1838/	.1975
Hystrene S-97	lb.	.1863/	.2125
T-45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.33 /	.37
MODX	lb.	.295 /	.345
NA-22	lb.	1.00	
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.165 /	.205
Groco 2, 4, 8, 18	lb.	.165 /	.205
Plastone	lb.	.27 /	.30
Polyac	lb.	1.85	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1463/	.1725
150	lb.	.1738/	.20
Hydrofol 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco	lb.	.125 /	.145
Rufat 75	lb.	.1188/	.145
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1413/	.1675
Groco 53	lb.	.1475/	.1675
Wilmar 253	lb.	.1413/	.1675
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.1525/	.1725
Wilmar 254	lb.	.1463/	.1725
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.175 /	.195
Wilmar 255	lb.	.1688/	.195
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.165 /	.205
434	lb.	.1375/	.1775
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
S	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.81 /	.83
CD	lb.	.76 /	.78
Albasan	lb.	.69 /	.73
Allied AA-1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.55 /	.60
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	$0.23 /	$0.24
Antisun	lb.	.15 /	.51
Antox	lb.	.55 /	.57
Aranox	lb.	3.25 /	.54
Betanox Special	lb.	.85 /	.90
B-L-E, -25	lb.	.55 /	.60
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.55 /	.60
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Flectol H	lb.	.55 /	.62
Flexamine	lb.	.76 /	.81
Heliozone	lb.	.31 /	.32
Ionol	lb.	.91 /	1.65
Microflake	lb.	.20 /	.24
NBC	lb.	1.55	
Neozone A	lb.	.59 /	.61
C	lb.	.83	
D	lb.	.55 /	.57
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Octamine	lb.	.55 /	.60
PDA-10	lb.	.46 /	.48
Perflectol	lb.	.61 /	.68
Permalux	lb.	2.17 /	.
Polygard	lb.	.55 /	.60
Polylite	lb.	.55 /	.60
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	.97 /	1.04
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.55 /	.62
Santovar A	lb.	1.50 /	1.57
Santowhite Crystals, Powder	lb.	1.55 /	1.62
L	lb.	.55 /	.62
MK	lb.	1.25 /	1.32
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof -713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Tenamene 3	lb.	.91 /	1.05
Thermoflex A	lb.	1.00 /	1.02
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.245
Velvapex 51-250	lb.	.40 /	
V-G-B	lb.	.75 /	.80
Wing-Stay S	lb.	.53 /	.65
Zenite	lb.	.52 /	.54

Antiozonants

Tenamene 30, 31	lb.	1.36 /	1.38
UOP 88, 288	lb.	1.36 /	1.38

Antiseptics

Copper naphthenate, 6-8%	lb.	.245	
Pentachlorophenol	lb.	.22 /	.30
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.07 /	.09
Carbonate	lb.	.16	
Blowing Agent CP 1475	lb.	.32 /	.35
Celogen	lb.	1.95	
50-C	lb.	1.01 /	1.07
Sodium bicarbonate	100 lbs.	2.55 /	3.85
Carbonate, tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel ND	lb.	.76	
NDX	lb.	1.52	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.70 /	.805
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
Hylene M	gal.	3.50 /	3.75
M-50	gal.	1.90 /	2.15
Thixons	gal.	1.48 /	12.00
Ty Ply BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.026
Resinex L-S	lb.	.0225/	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.15 /	.195
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Collocarb EPC	lb.	.059 /	.099
Continental AA	lb.	.074 /	.1225

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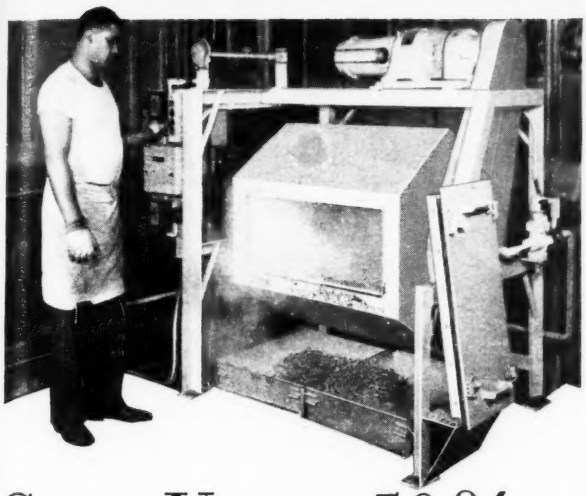
* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.



Save Up to 50% on Deflashing with CO_2 Tumbling System

How CO_2 Tumbling Works

In CO_2 tumbling, parts to be deflashed are placed in a specially designed revolving barrel. Extremely cold (-110° F.) dry ice or liquid CO_2 is then introduced into the barrel, freezing the flashing or rind. Tumbling action of the barrel cleanly strips off the embrittled flashing, giving parts a smooth, completely flash-free finish.

How CO_2 Tumbling Cuts Deflashing Costs

By automatically deflashing up to 200 pounds of rubber products in one fast operation! Costly, time-consuming hand trimming is eliminated. Parts are ready for assembly or shipment in a fraction of the time required by other deflashing methods.

Most Parts Lend Themselves to CO_2 Tumbling

Practically all molded rubber parts and products . . . from automotive components to kitchenware.

CO_2 Tumbling Equipment Pays For Itself

Initial cost as well as operating costs of a complete CO_2 tumbling installation are amazingly low. Many manufacturers report recovery of their investment within less than one year.

The Liquimatic Rubber Tumbling Barrel

Designed, engineered and manufactured by LIQUID . . . world leader in CO_2 refrigeration for over 60 years. Only the LIQUIMATIC Tumbling Barrel gives you *all* these advantages:

Uses either liquid CO_2 or dry ice.

Special "freeze-lock" construction has no cold-conducting connections from liner to shell.

Variable Speed Drive — ranges from 15 to 52 RPM — gives the ideal speed for all types of tumbling.

Automatic control of time and temperature . . . down to -100° F.

Removable stainless steel baffles — greater tumbling flexibility.

Heavy duty construction throughout.

No other barrel — at any price — offers the tumbling efficiency of the LIQUIMATIC. Get the complete story — mail the coupon below.

How You Can Get More Information

Contact The Liquid Carbonic Corporation, world's largest producer of CO_2 and a pioneer in CO_2 tumbling. Questions on any phase of CO_2 tumbling will receive prompt attention from qualified experts. Descriptive literature is also available. Simply mail the coupon.

World's Largest Producer of

THE LIQUID CARBONIC CORPORATION

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Please send me full particulars on The Removal of Flashing with CO_2 Tumbling.

Name_____

Title_____

Company_____

Address_____

City_____ Zone___ State_____

Kosmobile 77/Dixiedensed			
77	lb.	$0 074 /	$0.1225
Micronex W-6	lb.	.07 /	.1225
Spheron #9	lb.	.0725/	.1225
Texas E	lb.	.074 /	.1225
Witco #12	lb.	.074 /	.1225
Wyex EPC	lb.	.0725/	.13
Hard Processing Channel—HPC			
Continental F	lb.	.074 /	.1225
HX HPC	lb.	.074 /	.1225
Kosmobile S/Dixiedensed			
S	lb.	.074 /	.1225
Micronex Mk II	lb.	.07 /	.1225
Witco #6	lb.	.074 /	.1225
Medium Processing Channel—MPC			
Arrow MPC	lb.	.0725/	.13
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed			
S-66	lb.	.074 /	.1225
Micronex Standard	lb.	.07 /	.1225
Spheron #6	lb.	.0725/	.1225
Texas 109	lb.	.079 /	.1275
M	lb.	.074 /	.1225
Witco #1	lb.	.074 /	.1225
Conductive Furnace—CF			
Aromex CF	lb.	.0825 /	.14
Vulcan C	lb.	.105 /	.15
SC	lb.	.18 /	.223
Fast Extruding Furnace—FEF			
Aromex FEF	lb.	.0625 /	.12
Continex FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.06 /	.10
Sterling SO	lb.	.0625/	.10
Fine Furnace—FF			
Statex B	lb.	.065 /	.105
Sterling 99	lb.	.0675 /	.105
High Abrasion Furnace—HAF			
Aromex HAF	lb.	.0725/	.13
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.0725 /	.12
Statex R	lb.	.07 /	.12
Vulcan #3	lb.	.0725 /	.114
Intermediate Super Abrasion Furnace—ISAF			
Aromex ISAF	lb.	.0875/	.145
Kosmos 70/Dixie 70	lb.	.10 /	.145
Philblack I	lb.	.0875 /	.135
Statex 125	lb	.085 /	.135
Vulcan 6	lb.	.0875 /	.13
Medium Abrasion Furnace—MAF			
Philblack A	lb.	.0625 /	.11
Super Abrasion Furnace—SAF			
Philblack E	lb.	.115 /	.1625
Vulcan 9	lb.	.115 /	.165
General Purpose Furnace—GPF			
Arogen GPF	lb.	.055 /	.1125
Sterling V	lb.	.055 /	.09
V Non-staining	lb.	.05 /	.09
High Modulus Furnace—HMF			
Collocarb HMF	lb.	.045 /	.085
Continex HMF	lb.	.055 /	.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex HMF	lb.	.0575 /	.115
Statex 93	lb.	.0525/	.095
930	lb.	.047 /	.087
Sterling L, LL	lb.	.0575 /	.095
Semi-Reinforcing Furnace—SRF			
Collocarb SRF	lb.	.042 /	.082
Continex SRF	lb.	.045 /	.085
Essex SRF	lb.	.0525 /	.11
Furnex	lb.	.0475/	.0875
Gastex	lb.	.0575 /	.0925
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.0525 /	.0875
Sterling NS, S	lb.	.0475/	.0875
R	lb.	.0575 /	.0925
Fine Thermal—FT			
P-33	lb.	.0575	
Sterling FT	lb.	.0575	
Medium Thermal—MT			
Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	.04	
Stainless	lb.	.05	

Colors

Black

Iron oxides, comml	lb.	.1325/	.135
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico	lb.	.1425/	.145
Lampblack, comml	lb.	.16 /	.45
Superjet	lb.	.085 /	.12
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Alkali Blue	lb.	$1.12 /	$2.10
Cyanamid ultramarine	lb.	.29	
Du Pont	lb.	1.77 /	4.55
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	1.55 /	1.60
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml	lb.	.1425/	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1525/	.155
Sienna, burnt, comml	lb.	.0425/	.155
Williams	lb.	.115 /	.1775
Raw, comml	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml	lb.	.06 /	.07
Williams	lb.	.0725/	.085
Raw, comml	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan 15, 20	lb.	.2275/	.23
Metallic Brown	lb.	.05 /	.06
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.19 /	.50
Green	lb.	.80 /	2.40
Oxide	lb.	.3925/	1.10
Cyanamid	lb.	1.10	
G-4099, -6099	lb.	.4525	
GH-9869	lb.	1.10 /	1.25
9976	lb.	1.20 /	1.35
Du Pont	lb.	1.97 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone	lb.	1.75 /	4.60
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Cyanamid Permatons	lb.	1.35	
Du Pont	lb.	2.75	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone	lb.	.70 /	5.05
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.285 /	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Brilliant Toning Red	lb.	1.95	
Cadmium red lithopones	lb.	2.21 /	3.77
Cadmolith	lb.	1.72 /	2.20
Cyanamid	lb.	.85 /	1.60
Du Pont	lb.	1.47 /	1.90
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml	lb.	.06 /	.13
Lansco synthetic	lb.	.1175	
Mapico	lb.	.1375/	.14
Recco	lb.	.12	
Williams Red	lb.	.13 /	.1525
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	.85 /	6.15
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.04 /	.0675

White

Antimony oxide	lb.	.27 /	.285
Burgess Iceberg	ton	50.00 /	80.00
Cryptone BT	lb.	.10 /	.11
Permolith lithopone	lb.	.08 /	.0875
Titanium pigments			
Rayox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.21 /	.22
C-50	lb.	.1225/	.1275
RA, -10, -50	lb.	.23 /	.24
RC	lb.	.0825/	.0875
-HT, -HTX	lb.	.08 /	.085
Unitane	lb.	.245 /	.275
Zopaque Anatase	lb.	.245 /	.27
Rutile	lb.	.205 /	.29
Zinc oxide, comml	lb.	.145 /	.1825
Azo ZZZ-11, -44, -55	lb.	.145 /	.165
20% leaded	lb.	.1505/	.1705
35% leaded	lb.	.155 /	.175
50% leaded	lb.	.1588/	.1788
Eagle AAA, lead free	lb.	$0.145 /	$0.155
5% leaded	lb.	.145 /	.155
35% leaded	lb.	.155 /	.165
50% leaded	lb.	.159 /	.169
Florence Green Seal	lb.	.1625/	.1725
Red Seal	lb.	.1575/	.1675
White Seal	lb.	.1675/	.1775
Horsehead XX-4, -78	lb.	.145 /	.155
Kadox-15, -17, -72, -515	lb.	.145 /	.155
-25	lb.	.1675/	.1775
Lehigh, 35% leaded	lb.	.155	
50% leaded	lb.	.1588/	.1788
Protox-166, -167	lb.	.145 /	.165
St. Joe, lead free	lb.	.122 /	.152
Zinc sulfide, comml	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.273

Yellow

Cadmium yellow lithopones	lb.	1.12 /	1.15
Cadmolith	lb.	1.12 /	1.20
Cyanamid Hansa Yellow	lb.	2.10	
Du Pont	lb.	1.80 /	2.25
Filo	lb.	.10	
Iron oxide, comml	lb.	.0525/	.1175
Lansco synthetic	lb.	.1075	
Mapico	lb.	.115 /	.1225
Williams	lb.	.115 /	.1225
Monsanto Yellow 14	lb	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone	lb.	1.00 /	1.55
Vansul masterbatch	lb.	.95 /	1.95
Williams Ocher	lb.	.0575/	.06

Dusting Agents

Diatomaceous silica	ton	32.00 /	48.00
Extrud-o-Lube, conc	gal.	1.33 /	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.25 /	1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30 /	.35
Lubrex	lb.	.25 /	.30
Mica Concord	lb.	.075 /	.0825
Mineralite	ton	45.00	
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Talc, comml	ton	18.40 /	38.50
EM	ton	11.00 /	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00 /	36.00
Sierra Sagger 7	ton	34.00	
White 1R	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00 /	

Extenders

BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
Cumar Resins	lb.	.065 /	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.263
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
G. B. Asphaltenes	lb.	.06 /	.065
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38 00 /	40.00
Hard Hydrocarbon	ton	46 50 /	48.50
Hydrocarbon MR	ton	45.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.16 /	.2572
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.192 /	.2103
Stan-Shells	ton	35.00 /	73.00
Sublac Resin PX-5	lb.	.215 /	.235
Sundex 53	gal.	.12	
.85	gal.	.1725	
Synthetic 100	lb.	.41	
Vistanex	lb.	.35 /	475

Fillers, Inert

Agrashell flour	ton	50.00 /	74.00
Barytes, floated, white	ton	49.00 /	70.85
Off-color, domestic	ton	25 00	
No. 1	ton	49.00 /	71.50
2	ton	47.00 /	69.50
Sparmite	ton	90.00 /	110.00
Blanc fixe	ton	100.00 /	165.00
Burgess Iceberg	ton	50.00 /	80.00
Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
HC-75	ton	12.00 /	30.00
-80	ton	14.00 /	32.00
WP #1	ton	11.00 /	16.00
Cary #200	ton	30.00 /	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays			
A. F. D. Filler	ton	26.50 /	100.00
Aiken	ton	14.00	
Albacar	ton	50.00 /	55.00
Aluminum Flake	ton	22.25 /	60.00
#5	ton	24.50 /	30.00
Champion	ton	14.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.00	
Franklin	ton	13.50 /	35.25

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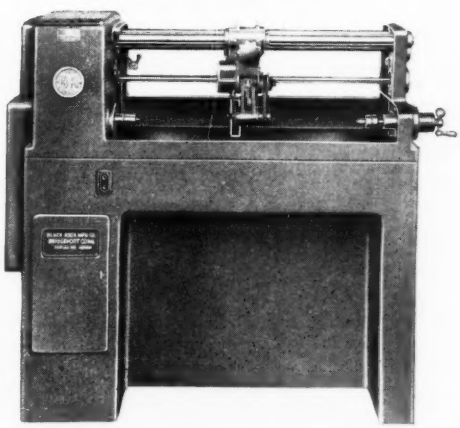

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For many years Warren S. Lockwood edited and distributed "Lockwood's Monthly Rubber Report," which was widely read in the United States and 20 countries overseas. For many years, also, Howard H. Heilman has been one of the country's leading authorities on butadiene and an internationally known consultant on synthetic rubber generally.

Now the synthetic plants are in private hands and what takes place in the production, distribution and pricing of butadiene, styrene, GR-S and other synthetics affects the entire industry from the Indonesian smallholder to the largest consumer of rubber. Equally what happens in the production, distribution and pricing of natural rubber vitally affects the synthetic industry—from prospective Texas butadiene producers to developers of completely new synthetic polymers.

Lockwood and Heilman are in a unique position to comment usefully on this constantly changing picture. Lockwood reported on rubber from Singapore, Djakarta and London for the U. S. Government, served as Executive Vice-President of the Rubber Manufacturers' Association and for many years was president of the Natural Rubber Bureau. Heilman was in charge of butadiene production for the Office of Rubber Reserve and is recognized by both government and industry leaders as a top expert on synthetic rubber costing. For the past 10 years he has served firms in the chemical and petroleum field as a consultant on petro-chemicals and related products.

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1701 K Street, N.W.
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Clays (*cont'd*)			
GK Soft Clay	ton	$11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
Paragon	ton	13.50	/ $31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00 /	32.00
Swanee	ton	12.50	
Windsor	ton	14.00 /	30.00
DC Silica	lb.	1.45 /	1.65
Diatomaceous silica	ton	32.00 /	48.00
Flocks			
Cotton, dark	lb.	.095 /	.135
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.22 /	2.46
Kalite	ton	50.00 /	65.00
Lithopone, comml	lb.	.075 /	.085
Astrolith	lb.	.06¾ /	.0675
Eagle	lb.	.0725 /	.075
Permolith	lb.	.08 /	.0875
Sunolith	lb.	.075 /	.0825
Mica Concord	lb.	.075 /	.0825
Millical	ton	38.00 /	53.00
Mineralite	ton	40.00 /	60.00
Non-Fer-Al	ton	32.50 /	47.50
Purecal	ton	56.75 /	71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00 /	35.00
Silversheen Mica	lb.	.08 /	.09
StanWhite	ton	10.50 /	13.10
Super-White Silica	ton	25.00 /	46.50
Surfex	ton	37.50 /	52.50
MM	ton	39.50 /	54.50
Suspenso	ton	35.50 /	50.50
Ti-Cal	lb.	.0675	
Valron estersil	lb.	2.00 /	2.25
Walnut shell flours	ton	40.00 /	80.00
Whiting, limestone			
Atomite	ton	30.00	
Calcite	ton	23.00	
Calwhite	ton	20.00	
-T	ton	23.00	
Gamaco	ton	32.50	
Keystone	ton	16.00	
Laminar	ton	30.00	
No. 10 White	ton	11.00	
Omya	ton	30.00	
Paxinosa	ton	11.00 /	19.00
Snowflake	ton	17.00 /	18.00
Stonelite	ton	9.00	
Witco	ton	8.50	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50 /	8.00
Flocks, Rayon, colored	lb.	.90 /	1.50
White	lb.	.75 /	1.25
Also see Flocks, under Fillers, Inert			
Rubber lacquer, clear	gal.	1.00 /	2.00
Shellacs, Angelo	lb.	.485 /	.7325
Vac Dry	lb.	.485 /	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15 /	.20
Wax, Bees	lb.	.68 /	.83
Carnauba	lb.	.57 /	1.13
Monten	lb.	.27	
No. 118, colors	gal.	.86 /	1.41
Neutral	gal.	.76 /	1.31
Van Wax	gal.	1.45 /	1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06 /	.075
FA #1	lb.	.065 /	.08
#2	lb.	.075 /	.09
Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00 /	1.15
-144	lb.	.15 /	.30
-307	lb.	1.10 /	1.25
-311	lb.	.60 /	.75
Aerosol, dry types	lb.	.39 /	1.20
Liquid types	lb.	.40 /	.72
Alcogum AN-6	lb.	.05	
AN-10	lb.	.085	
Alrosol	lb.	.41	
Alrowet D-75	lb.	.63	
Amberex solutions	lb.	.1675 /	.18
Antifoam J-114	lb.	3.25 /	3.45
P-242	lb.	.24 /	.35
Antioxidant J-137, -140	lb.	.55 /	.70
-139, -293	lb.	1.45 /	1.60
-182	lb.	2.00 /	2.15
-186	lb.	1.40 /	1.55
2246	lb.	1.50 /	1.53
Anti Webbing Agent J-183	lb.	.75 /	.90
-297	lb.	.27 /	.40
Aquablak B	lb.	.0975 /	.1025
G	lb.	.12 /	.125
K	lb.	.12 /	.125
M	lb.	.105 /	.11
Aquarex D	lb.	.78	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.80	
Aquarex NS	lb.	$0.60	
SMO	lb.	.50	
WAQ	lb.	.22	
Areskap 50	lb.	.30 /	$0.38
100, dry	lb.	.60 /	.72
Aresket 240	lb.	.30 /	.38
300, dry	lb.	.60 /	.72
Aresklene 375	lb.	.42 /	.57
Ben-A-Gels	lb.	.98 /	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -40, -300	lb.	1.00 /	1.17
CW-12	lb.	.85	
37	lb.	.70	
DC Antifoam A Compound	lb.	5.45 /	6.65
Emulsion	lb.	2.05 /	4.00
AF Emulsion	lb.	2.05 /	2.85
Compound 7	lb.	5.13 /	6.50
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
Dispersing Agents			
Blancol	lb.	.1525 /	.26
N	lb.	.155 /	.26
Darvan Nos. 1, 2, 3	lb.	.22 /	.30
Daxad 11, 21, 23, 27	lb.	.08 /	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Empulphor ON-870	lb.	.50 /	.70
Igepal CO-630	lb.	.2875 /	.47
Igepon T-73	lb.	.285 /	.495
T-77	lb.	.45 /	.69
Indulins	lb.	.06 /	.08
Kreelons	lb.	.132 /	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52 /	.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225 /	.1425
N	lb.	.095 /	.105
Modicols	lb.	.17 /	.58
Nekal BA-75	lb.	.395 /	.54
BX-76	lb.	.63 /	.75
Pluronics	lb.	.335 /	.40
Polyfons	lb.	.08 /	.09
Sorapon SF-78	lb.	.28 /	.40
Tergitol NPX	lb.	.275 /	.3074
TMN	lb.	.2875 /	.32
7	lb.	.4125 /	.44
Trenamine	lb.	.15	
Triton R-100	lb.	.12 /	.25
X-100, -102, -114	lb.	.255 /	.36
Dispersions			
Agebest 1293-22A	lb.	1.90 /	2.00
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Black No. 25	lb.	.22	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30 /	.35
P-33	lb.	.35	
Rayox	lb.	.45	
Rotax	lb.	.75	
Sulfur	lb.	.12 /	.30
No. 2	lb.	.14 /	.16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.60	
Vulcanizing, C group	lb.	.40 /	1.30
G group	lb.	.45 /	.90
N group	lb.	.40 /	1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Borden Arcco A-25, A-26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
Habuco Resin Nos. 502, 515, 523	lb.	.195 /	.20
503	lb.	.22 /	.225
504, 526	lb.	.19 /	.195
517	lb.	.175 /	.18
524	lb.	.155 /	.16
Resin A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Gelling Agent P-397	lb.	.34 /	
Igepon T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Indulins	lb.	.06 /	.08
Ludox	lb.	.1675 /	.195
Marmix	lb.	.41 /	.48
Merac	lb.	.75 /	1.05
Micronex, colloidal	lb.	.06 /	.072
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD-101	lb.	.16 /	.26
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Polyvinyl methyl ether	lb.	.25 /	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	$0.44 /	$0.65
S	lb.	.13 /	.25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905 /	.975
30A	lb.	.245 /	.265
ST	lb.	.585 /	.615
Setsit #5	lb.	.75 /	1.05
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
Stablex P	lb.	.35 /	.50
T	lb.	.14 /	.22
Surfactol 13	lb.	.345 /	.36
Webnix	lb.	1.50 /	2.50

Mold Lubricants

Acintol D	lb.	.06 /	.075
A-C Polyethylene	lb.	.30 /	.37
Alipal CO-433	lb.	.25 /	.45
CO-436	lb.	.22 /	.41
Aquarex Compounds	lb.	.21 /	.94
Carbowax 200, 300, 400	lb.	.22 /	.25
1500	lb.	.255 /	.2825
4000	lb.	.31 /	.32
6000	lb.	.35 /	.36
Castorwax	lb.	.3325 /	.3525
Colite Concentrate	gal.	.90 /	1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14 /	4.75
Compound 4, 7	lb.	5.13 /	6.50
Emulsion 7	lb.	1.59 /	2.07
8, 35, 35A, 35B, 36	lb.	1.26 /	1.80
200 Fluid	lb.	3.14 /	4.75
ELA	lb.	.82	
FT Wax 200	lb.	.265 /	.42
300	lb.	.295 /	.45
Glycerized Liquid Lubricant, concentrated	gal.	1.25 /	1.63
Igepals	lb.	.2875 /	.74
Igepon AP-78	lb.	.44 /	.68
T-43	lb.	.145 /	.35
-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Lubrex	lb.	.25 /	.30
Lubri-Flo	gal.	10.00 /	12.05
Lustermold	lb.	.41	
L-41 Diethyl Silicone Oil	lb.	3.50	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
Para Lube	lb.	.046 /	.048
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Pluronics	lb.	.335 /	.44
Polyglycol E series	lb.	.29 /	.42
Rubber-Glo	gal.	.94 /	.97
SM-33, -55, -61, -62	lb.	1.22 /	1.76
Soap, Hawkeye	lb.	1.35 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20 /	1.25
800 series	gal.	1.26 /	1.70
900 series	gal.	1.55 /	2.55
A Series	gal.	1.80 /	4.50
Ucon 50-HB Series	lb.	.25 /	.375
Ulco	lb.	.12 /	.23
Vanfre	gal.	2.50 /	3.00

Odorants

Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Curodex 19	lb.	4.75 /	5.05
188	lb.	5.75	
198	lb.	6.75	
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

Plasticizers and Softeners

Acintol R	lb.	.065 /	.07
Adipol 2EH, 10A	lb.	.40 /	.435
BCA	lb.	.43 /	.455
ODY	lb.	.45 /	.485
Admex 710	lb.	.325	
711	lb.	.345	
744	lb.	.40	
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.215 /	.235
B	lb.	.0625 /	.065
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.27 /	.30
Bondogen	lb.	.55 /	.60
BRC 20	lb.	.15 /	.175
22	lb.	.025 /	.0275
30	lb.	.0125 /	.021
521	lb.	.019 /	.02
BRH 2	lb.	.0213 /	.0351
BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
BRV	lb.	.0475 /	.0565
Bunarex Liquid	lb.	.0425 /	.0555
Resins	lb.	.065 /	.1225
Bunnatol G, S	lb.	.40 /	.505
Butac	lb.	.125 /	.135
Butyl stearate, comml	lb.	.255	
Binney & Smith	lb.	.23 /	.26
Hardesty	lb.	.23 /	.26
Ohio-Apex	lb.	.22 /	.255
Cabflex HS-10	lb.	.44 /	.47
Califlux 510, 550	lb.	.025 /	.0325
G, P	lb.	.0125 /	.02
R-100	lb.	.045 /	.0525
TT	lb.	.017 /	.0245

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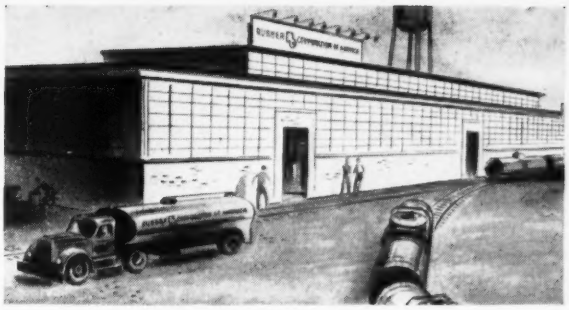

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Capryl alcohol, comml.	lb.	$0.195 /	$0.235
Binney & Smith	lb.	.18 /	.28
Hardesty	lb.	.18 /	.28
Chlorowax 40	lb.	.1625/	.1825
70	lb.	.185 /	.245
-S	lb.	.21 /	.27
Circo light	gal.	.17	
Circosol-2XH	gal.	.185	
Contogums	lb.	.0875/	.111
Cumar resins	lb.	.065 /	.17
DBM (dibutyl-m-cresol)			
Darex	lb.	.32 /	.3475
DBP (dibutyl phthalate), comml.	lb.	.30 /	.33
Darex	lb.	.30 /	.33
Eastman	lb.	.30 /	.33
Hatco	lb.	.30 /	.33
Monsanto	lb.	.30 /	.33
Naugatuck	lb.	.30 /	.33
Ohio-Apex	lb.	.30 /	.335
PX-104	lb.	.30 /	.33
Rubber Corp. of America	lb.	.30 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (dibutylsebacate), comml.	lb.	.66 /	.69
Hatco	lb.	.66 /	.685
Monoplex	lb.	.66 /	.675
Naugatuck	lb.	.665 /	.69
PX-404	lb.	.665 /	.69
DPC (dicaprylphthalate), comml.	lb.	.295 /	.325
Hatco	lb.	.295 /	.325
Monoplex	lb.	.30 /	.315
DDA (didecyladipate)			
Cabflex	lb.	.425 /	.455
Good-rite GP-236	lb.	.40 /	.55
DDP (didecylphthalate)			
Cabflex	lb.	.305 /	.335
Good-rite GP-266	lb.	.295 /	.45
Hatco	lb.	.305 /	.435
Defoamer X-3	lb.	.355	
DIBA (diisobutyladipate)			
Cabflex	lb.	.4325/	.4625
Darex	lb.	.4325/	.4625
Eastman	lb.	.41 /	.44
Ohio-Apex	lb.	.41 /	.445
DIDA (diisodecyladipate)			
Monsanto	lb.	.425 /	.455
DIDP (diisodecylphthalate)			
Darex	lb.	.32 /	.35
Monsanto	lb.	.305 /	.335
Ohio-Apex	lb.	.295 /	.33
PX-120	lb.	.305 /	.335
Dielex B	lb.	.06	
Diethylene glycol, comml.	lb.	.1525/	.1825
Wyandotte	lb.	.15 /	.165
Dinopol IDO	lb.	.29 /	.325
DIOA (diisooctyladipate)			
Cabflex	lb.	.425 /	.455
Naugatuck	lb.	.435 /	.465
PX-208	lb.	.425 /	.455
Rubber Corp. of America	lb.	.425 /	.56
DIOP (diisooctylphthalate), comml.	lb.	.305 /	.335
Cabflex	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.305 /	.335
Hatco	lb.	.305 /	.335
Monsanto	lb.	.305 /	.335
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.285 /	.32
PX-108	lb.	.305 /	.335
Rubber Corp. of America	lb.	.305 /	.45
Sherwin-Williams	lb.	.32 /	.34
DIOS (diisooctylsebacate), comml.	lb.	.61 /	.64
Rubber Corp. of America	lb.	.61 /	.84
DIOZ (diisooctylazelate)			
Cabflex	lb.	.48 /	.51
Dipolymer Oil	gal.	.33 /	.38
Dispersing Oil No. 10	lb.	.06 /	.0625
DNODP (di-n-octyl-n-decyl phthalate), Monsanto	lb.	.345 /	.375
DOA (dioctyladipate), comml.	lb.	.425 /	.455
Cabflex	lb.	.425 /	.455
Eastman	lb.	.40 /	.43
Good-rite GP-233	lb.	.40 /	.55
Hatco	lb.	.435 /	.465
Monsanto	lb.	.425 /	.455
Naugatuck	lb.	.435 /	.465
PX-238	lb.	.425 /	.455
Rubber Corp. of America	lb.	.425 /	.56
DOP (dioctylphthalate), comml.	lb.	.305 /	.335
Cabflex	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.305 /	.335
Good-rite GP-261	lb.	.285 /	.44
Hatco	lb.	.305 /	.335
Monsanto	lb.	.305 /	.335
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.285 /	.32
PX-138	lb.	.305 /	.335
Rubber Corp. of America	lb.	.305 /	.45
Sherwin-Williams	lb.	.305 /	.335
DOS (dioctylsebacate), comml.	lb.	.61 /	.64
Eastman	lb.	.61 /	.64
Hatco	lb.	.61 /	.635
Monoplex	lb.	.61 /	.635
Naugatuck	lb.	.615 /	.64
PX-438	lb.	.615 /	.64
Rubber Corp. of America	lb.	.61 /	.84
Drapex 3.2	lb.	.40 /	.45
Dutch Boy NL-A10 (DBP)	lb.	.30 /	.33
-A20 (DOP), A30 (DIOP)	lb.	.305 /	.335
-A54	lb.	.295 /	.325
-C20 (DOS)	lb.	.61 /	.63
-F21	lb.	$0.395 /	$0.425
-F31	lb.	.44 /	.47
-F41	lb.	.48 /	.51
Dutrex 6	lb.	.025 /	.035
Dymerex Resin	lb.	.135 /	.1475
Emulphor EL-719	lb.	.52 /	.73
Endor	lb.	.65	
Ethox	lb.	.43 /	.455
Ethylene glycol, comml.	lb.	.135 /	.165
Wyandotte	lb.	.1325/	.1425
Flexol 3 GH	lb.	.44 /	.46
3 GO	lb.	.53 /	.55
4 GO	lb.	.325 /	.355
10-A	lb.	.425 /	.455
426	lb.	.27 /	.30
810, 810X, 10-10, 10-10X	lb.	.305 /	.335
TOF, A-26	lb.	.435 /	.465
Flexricin P-4	lb.	.3475/	.3625
P-6	lb.	.415 /	.43
P-8	lb.	.3475/	.3625
PG-16	lb.	.335 /	.35
Fortex	lb.	.125 /	.145
G. B. Asphaltic Flux	gal.	.08 /	.14
Naphthenic Neutrals	gal.	.11 /	.18
Process oil, light	lb.	.025 /	.0325
Medium	lb.	.035 /	.0425
Galex W-100	lb.	.155 /	.18
W-100 D	lb.	.1525/	.1775
Gilsowax B	lb.	.0975/	.11
Harchemex	lb.	.25 /	.34
Harflex 10	lb.	1.25 /	1.335
40	lb.	.64 /	.725
50, 80, 300	lb.	.58 /	.665
60	lb.	.62 /	.705
90	lb.	.88 /	.965
120, 150	lb.	.305 /	.395
140, 160	lb.	.30 /	.33
180	lb.	.295 /	.38
220, 250	lb.	.425 /	.515
260	lb.	.42 /	.45
280	lb.	.42 /	.51
500	lb.	.315 /	.41
HB-20	lb.	.15 /	.17
-40	lb.	.19 /	.21
Heavy Resin Oil	lb.	.0225/	.0375
HSC-13	lb.	.27 /	.30
Indonex	gal.	.11 /	.19
Kapsol	lb.	.3225/	.3525
Kenflex A, L	lb.	.26 /	.27
B	lb.	.23 /	.24
N	lb.	.18 /	.19
Kessoflex 103	lb.	.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.29 /	.325
-90	lb.	.40 /	.435
-140	lb.	.46 /	.485
-201	lb.	.5825/	.5925
-220	lb.	.31 /	.345
-555	lb.	.525 /	.55
Kronisol	lb.	.33 /	.365
Kronitex AA, I, K-3, Mx	lb.	.345 /	.38
LX-685, -125, -135	lb.	.125 /	.135
Marvinol plasticizers	lb.	.28 /	.8825
Methox	lb.	.385 /	.41
Monoplex S-38	lb.	.215 /	.24
S-71	lb.	.45 /	.475
Morflex	lb.	.25 /	.65
Natac	lb.	.12 /	.13
Neoprene Peptizer P.-12	lb.	1.05	
Nevillac	lb.	.31 /	.85
Neville R Resins	lb.	.145 /	.205
Nevinol	lb.	.24	
No. 1-D heavy oil	lb.	.065	
ODA (octyldecyladipate)			
Cabflex	lb.	.425 /	.455
Good-rite GP-235	lb.	.40 /	.55
ODP (octyldecylphthalate)			
Cabflex	lb.	.305 /	.335
Good-rite GP-265	lb.	.29 /	.445
Hatco	lb.	.305 /	.335
Rubber Corp. of America	lb.	.305 /	.45
Ohopex Q-10	lb.	.295 /	.33
R-9	lb.	.3525/	.3775
Orthonitro benzophenol, comml.	lb.	.13 /	.15
Monsanto	lb.	.13 /	.15
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.185 /	.225
Para Flux, regular	gal.	.10 /	.2125
No. 2016	gal.	.165 /	.24
2332	gal.	.11	
4205	lb.	.1075/	.2125
Para Lube	lb.	.046 /	.048
Resins	lb.	.04 /	.045
Paradene Resins	lb.	.07 /	.08
Paraplex 5-B	lb.	.29 /	.3475
AL-111	lb.	.32 /	.3275
G-25	lb.	.76 /	.77
-40	lb.	.4825/	.51
-50	lb.	.39 /	.4175
-53	lb.	.4325/	.46
-60	lb.	.325 /	.35
-62	lb.	.345 /	.37
RG-7	lb.	.33 /	.335
-8	lb.	.505 /	.5125
-10	lb.	.52 /	.5275
Pepton 22	lb.	.81 /	.84
65	lb.	1.20 /	1.23
65-B	lb.	.81 /	.84
Philrich 5	gal.	.11	
Picco Resins	lb.	.135 /	.195
480 Oilproof Series	lb.	.18 /	.23
Aromatic Plasticizers	lb.	.05 /	.065
Liquid Resin D-165 (Y)	lb.	.06 /	.075
(Z-3)	lb.	.07 /	.085
(Z-6)	lb.	$0.08 /	$0.095
S. O. S.	gal.	.29 /	.34
Piccocizers	lb.	.04 /	.055
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.12 /	.135
Piccovars	lb.	.165 /	.20
Piccovol	lb.	.025 /	.038
Pictar	gal.	.25 /	.30
Pigmentar	lb.	.046 /	.074
Pigmentaroil	lb.	.046 /	.074
Pine Tar, Sunny South	lb.	.046 /	.080
Oil, Sunny South	lb.	.046 /	.090
Pitch, Burgundy, Sunny South	lb.	.1030/	.1085
Plasticizers			
42	lb.	.34 /	.40
B	lb.	.35 /	.45
DP-520	lb.	.435 /	.455
MP	lb.	.035 /	.0755
MT-511	lb.	.535 /	.565
ODN	lb.	.35 /	.475
SC	lb.	.54 /	.63
Plastoflex #3	lb.	.52 /	.57
#520	lb.	.36 /	.435
DBE	lb.	.50 /	.55
MGB	lb.	.29 /	.37
SP-2	lb.	.43 /	.48
VS	lb.	.3575/	.3975
Plastogen	lb.	.0775/	.08
Plastone	lb.	.22 /	.3075
Polycin 470	lb.	.325 /	.34
Polycizers	lb.	.28 /	.55
162	lb.	.285 /	.44
Polymel D	lb.	.225 /	.235
C-128	lb.	.1775/	.1875
D-TAC	lb.	.1975/	.215
DX, C-130	lb.	.1375/	.1475
PT67 Light Pine Oil	gal.	.60	
101 Pine Tar Oil	lb.	.046 /	.0634
Pine Tars	lb.	.046 /	.0634
Reogen	lb.	.1325/	.135
Resin C pitch	lb.	.0225/	.031
R6-3	lb.	.38 /	.40
Resinex 10, 25, 50, 110	lb.	.04 /	.045
70	lb.	.0325/	.0375
85, 100	lb.	.035 /	.04
115	lb.	.0375/	.0425
L-2, L-3, L-4, L-5	lb.	.0225/	.03
Rosin Oil, Sunny South	gal.	.58 /	.875
RPA No. 2	lb.	.82	
3	lb.	.48	
Conc	lb.	.85	
5	lb.	.68	
6	lb.	1.62	
RSN Flux	gal.	.10 /	.91
Rubber Oil B-5	lb.	.0225/	.0355
Rubberol	lb.	.18 /	.2725
Santicizer 1-H	lb.	.50 /	.51
3	lb.	.46 /	.47
8	lb.	.43 /	.44
9	lb.	.39 /	.42
140	lb.	.33 /	.36
141	lb.	.34 /	.37
160	lb.	.25 /	.28
601	lb.	.325	
602	lb.	.305	
B-16	lb.	.4875/	.4975
E-15	lb.	.5075/	.5375
M-17	lb.	.4275/	.4575
Sebacic acid, purified, comml.	lb.	.59 /	.65
Binney & Smith	lb.	.64 /	.76
Hardesty	lb.	.64 /	.76
C.P.-Binney & Smith	lb.	.72 /	.84
Hardesty	lb.	.72 /	.84
Sherolatum Petrolatum	lb.	.05 /	.10
Softener #20	gal.	.10 /	.20
Special Rubber Resin 100	lb.	.1675/	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61 /	.635
Syn-Tac	gal.	.33 /	.35
Synthol	lb.	.17 /	.2625
Thiokol TP-90B	lb.	.59	
-95	lb.	.65	
Tricresyl phosphate, comml.	lb.	.33 /	.36
Cabflex	lb.	.345 /	.375
Monsanto	lb.	.33 /	.36
Naugatuck	lb.	.32 /	.36
PX-917	lb.	.33 /	.36
Triphenyl phosphate, comml.	lb.	.39 /	.40
Monsanto	lb.	.39 /	.40
Turgum S	lb.	.1075/	.1175
Tysonite	lb.	.24 /	.2475
United	gal.	.69 /	1.20
X-1 Resinous Oil	lb.	.0225/	.0325

Reclaiming Oils

Acintol C, P	lb.	.02 /	.03
Bardol, 639	lb.	.0275/	.0375
B	lb.	.0625/	.065
BRH 2	lb.	.0213/	.0351
BRT 3	lb.	.018 /	.0265
4	lb.	.025 /	.026
7	lb.	.03 /	.031
BRV	lb.	.0475/	.0565
Burco-RA	lb.	.053 /	.0805
BWH-1	lb.	.16 /	.18
Dipolymer Oil	gal.	.33 /	.43
Dispersing Oil No. 10	lb.	.06 /	.0625
G. B. Oils	gal.	.10 /	.24
Heavy Resin Oil	lb.	.0225/	.0375
LX-572	gal.	.27 /	.32
-759	gal.	.1375	
-777, -809, -859	gal.	.23 /	.33
-869	gal.	.33 /	.43
-871	gal.	.34 /	.44

No. 3186	gal.	$0.28 /	$0 295
Picco 6535	gal.	.25 /	.30
C-33	gal.	.215 /	.315
-42	gal.	.23 /	.33
D-4	gal.	.27 /	.37
E-5	gal.	.25 /	.35
Q-Oil	gal.	.286 /	.36
PT 67	gal.	.60	
101 Pine Tar Oil	lb.	.0427 /	.0610
150 Pine Solvent	gal.	.44	
Reclaiming Oil #3186	gal.	.28 /	.385
-G	gal.	.25 /	.365
4039-M	gal.	.3275 /	.3975
-V	gal.	.30 /	.37
RR-10	lb.	.37	
S. R. O.	lb.	.015 /	.0225
X-1 Resinous Oil	lb.	.0225 /	.0325
Reinforcers, Other Than Carbon Black			
Angelo Shellacs	lb.	.485 /	.7325
Borden, Chem. Div.			
Arcco 978-42B	lb.	.18 /	.19
1073-18B	lb.	.135 /	.145
1294-36B	lb.	.115 /	.125
1301-12B	lb.	.15 /	.16
BRC 20	lb.	.15 /	.175
22	lb.	.025 /	.0275
30	lb.	.0125 /	.021
521	lb.	.019 /	.02
Bunarex Resins	lb.	.065 /	.1225
Cab-o-sil	lb.	.68 /	.75
Calcene NC	ton	72.50 /	92.50
TM	ton	75.00 /	95.00
Calco S. A.	lb.	.85 /	.88
Clays			
Aiken	ton	14.00	
Aluminum Flake	ton	22.25 /	60.00
Buca	ton	45.00	
Burgess Iceberg	ton	50.00 /	80.00
Icecap K	ton	65.00 /	90.00
Pigment #20	ton	35.00 /	60.00
30	ton	37.00 /	60.00
Catalpo	ton	35.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.00	
Franklin	ton	13.50 /	35.25
L. G. B.	ton	17.00	
Paragon	ton	13.50 /	33.00
Pigment No. 33	ton	37.00	
Recco	ton	14.00	
Suprex	ton	14.00 /	33.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00 /	30.00
Witco No. 1	ton	14.00 /	30.00
No. 2	ton	13.50 /	30.00
Clearcarb	lb.	.1175 /	.1255
Cumar Resins	lb.	.065 /	.17
Darex Resins	lb.	.42 /	.49
DC Silica	lb.	1.45 /	1.65
Diatomaceous silica	ton	32.00 /	48.00
Good-rite Resin 50	lb.	.39 /	.41
K Series Polymers	lb.	.15 /	.37
Hi-Sil 101	lb.	.11 /	.125
233	lb.	.09 /	.105
X303	lb.	.40 /	.45
Hycar 2001	lb.	.55	
2007	lb.	.39	
Indulins	lb.	.06 /	.08
Kralac A-EP	lb.	.43 /	.54
Laminar	ton	30.00	
Magnesium carbonate, Merck	lb.	.105 /	.12
Marbon Resins	lb.	.39 /	.46
Multifex MM	ton	110.00 /	125.00
Super	ton	160.00 /	175.00
Neville Resins			
465	lb.	.075 /	.08
LX-509	lb.	.33 /	.35
Nebony	lb.	.045 /	.05
Paradene	lb.	.07 /	.08
R	lb.	.145 /	.205
Para Resins 2457, 2718	lb.	.04 /	.4575
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	.13 /	.225
Piccolyte Resins	lb.	.205 /	.275
Piccoumaron Resins	lb.	.07 /	.19
Piccovars	lb.	.145 /	.20
Pliolite NR types	lb.	.98 /	1.33
S-3, -6	lb.	.42 /	.49
-6B	lb.	.39 /	.46
Purecal M	ton	56.75 /	71.75
SC, T	ton	110.00 /	125.00
U	ton	120.00 /	135.00
R-B-H 510	lb.	.15 /	.22
Resinex	lb.	.0325 /	.0425
Rubber Resin LM-4	lb.	.28 /	.35
Silene EF	ton	120.00 /	140.00
Silvacons	ton	55.00 /	85.00
Witcarb R	ton	105.00 /	120.00
-12	ton	45.00 /	66.00
Zeolex 23	ton	120.00 /	140.00
Zinc oxide, commercial†	lb.	.135 /	.1775
Retarders			
Benzoic acid TBAO-2	lb.	.44 /	
E-S-E-N	lb.	.37 /	.39
Good-rite Vultrol	lb.	.62 /	.66
R-17 Resin	lb.	.1075 /	.36
Retarder ASA	lb.	.57	
J	lb.	.62 /	.64
PD	lb.	.37 /	.39
W	lb.	.42	
Retardex	lb.	.47 /	.50
Thionex	lb.	1.14	
Solvents			
Bondogen	lb.	$0.55 /	$0.60

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. . . stretches production dollars

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BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Butyrolactone	lb.	$0.60 /	$0.65
Cosol #1	gal.	.37 /	.43
#2	gal.	.42 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD, Sunny South	gal.	.40 /	.62
Ethylene dichloride, comml.	lb.	.09 /	.1225
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsolv H, 200	gal.	.19 /	.29
HF, T, 30	gal.	.24 /	.34
Penetrell	gal.	.40 /	62
Picco Hi-Solv Solvents	gal.	.16 /	.48
Pine Oil DD, Sunny South	lb.	.1225/	.1425
PT 150 Pine Solvent	gal.	.44	
Skellysolve-E	gal.	.153	
-H	gal.	.133	
-R, -V	gal.	.109	
-S	gal.	.099	
Stauffer Carbon Disulphide	lb.	.0525/	.085
Tetrachloride	lb.	.0825/	.475

Synthetic Rubber Monomers

Dow Styrene N99, H99	lb.	.205	
RG	lb.	.17	
Vinyltoluene	lb.	.17	
Hylene M	lb.	3.50 /	5.00
M-50	lb.	1.90 /	3.40
T	lb.	1.10 /	2.65
TM	lb.	.95 /	2.50
-65	lb.	1.00 /	2.55
Monomer MG-1	lb.	1.00 /	1.25
Mondur-C	lb.	1.05	
-S	lb.	.85	
Multron R-2	lb.	.54	
Rohm & Haas ethyl acrylate	lb.	.34 /	.36
Glacial methacrylic acid	lb.	.45 /	.47
Methyl acrylate	lb.	.37 /	.39
Methacrylate	lb.	.29 /	31

Synthetic Rubber Shortstops

DDM	lb.	.75 /	.88
Mercaptan 174	lb.	.38 /	.50
Shortstop 204	lb.	.33 /	.37
268	lb.	.52 /	.53
Tecquinol	lb.	.825 /	.845
Thiostop K	lb.	.53	
N	lb.	.41	

Tackifiers

Acintol R	lb.	.065 /	.07
Bardol, 639	lb.	.0275/	.0375
Borden, Arcco			
A25, A26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
BRH 2	lb.	.0213/	.0351
Bunarex Resins	lb.	.065 /	.1225
Chlorowax 70	lb.	.18 /	.24
Contogums	lb.	.0875/	.11
Cumar Resins	lb.	.065 /	.17
Galex W-100	lb.	.155 /	.17
W-100D	lb.	.1525/	.1625
Indopol H-35	gal.	.65 /	.81
H-50	gal.	.70 /	.86
-100	gal.	.85 /	1.05
-300	gal.	1.00 /	1.21
L-10	gal.	.40 /	.56
-50	gal.	.45 /	.61
-100	gal.	.55 /	.71
Kenflex resins	lb.	.18 /	.27
Koresin	lb.	.90 /	1.10
Natac	lb.	.12 /	.13
Nevindene	lb.	.15 /	.18
Picco Resins	lb.	.13 /	.185
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	25
Piccopale Resins	lb.	.089 /	.13
Piccoumaron Resins	lb.	.07 /	.185
R-B-H 510	lb.	.15 /	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	.17 /	.2625
United	gal.	.69 /	1.20

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60	
G-M-F #113, #117	lb.	.90	
Ko-Blend I, S	lb.	.39	
Litharge (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.2525/	.38
Merck, Light Calcined	lb.	.2525/	26
Extra Light Calcined	lb.	.2925/	.30
Red Lead (*See Accelerator-Activators, Inorganic*)			
Sulfasan R	lb.	1.50	
Sulfur flour, comml.	100 lbs.	2.55 /	3.30
Aero	100 lbs.	2.40 /	7.75
Crystex	lb.	.195 /	.23
Insoluble 60	lb.	.15 /	.155
Rubbermakers	100 lbs.	2.65 /	4.55
Stauffer	lb.	.0265/	.054
Telloy	lb.	2.50	
VA-7	lb.	.50 /	.60
Vandex	lb.	15.50	
Vultac No. 2	lb.	.47 /	.755
3	lb.	.51 /	.795
White lead silicate (*See Accelerator-Activators, Inorganic*)			

CALENDAR of COMING EVENTS

January 16

Washington Rubber Group. Pepco Auditorium, Washington, D. C.

January 16-18

Society of Plastics Engineers, Inc. Thirteenth Annual National Technical Conference. Hotel Sheraton-Jefferson, St. Louis, Mo.

January 23-25

Twelfth Annual Symposium on Instrumentation for the Process Industries. Texas A & M College, College Station, Tex.

January 25

Akron Rubber Group. Winter Meeting. Sheraton Mayflower Hotel, Akron, O.

Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Pa.

January 28-31

Plant Maintenance & Engineering Show and Conference. Public Auditorium, Cleveland, O.

February 1

Detroit Rubber & Plastics Group, Inc. Winter Meeting. Detroit Leland Hotel, Detroit, Mich.

February 3-7

National Sporting Goods Assn. Convention and Show. Hotel Morrison, Chicago, Ill.

February 5

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

February 5-7

Society of the Plastics Industry. Annual Reinforced Plastics Division Conference. Chicago, Ill.

February 7

Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

February 13

Washington Rubber Group. Pepco Auditorium, Washington, D. C.

February 15

Chicago Rubber Group. Furniture Club, Chicago, Ill.

February 15-16

Southern Rubber Group. Dallas, Tex.

February 19

Elastomer & Plastics Group, Northeastern Section, ACS. Student's Night. Science Park.

March 5

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

Buffalo Rubber Group. Spring Meeting. Hotel Westbrook, Buffalo, N. Y.

March 6-15

American Toy Fair. New York, N. Y.

March 15

Chicago Rubber Group. Furniture Club, Chicago, Ill.

Boston Rubber Group. Spring Meeting. Hotel Somerset, Boston, Mass.

March 17

Northeastern Section, ACS, and its Elastomer & Plastics Group. Joint Meeting. Symposium on Adhesives.

March 18-21

Society of the Plastics Industry, Inc. 1957 National Conference and Pacific Coast Plastics Exposition. Biltmore Hotel, Los Angeles, Calif.

March 20

Washington Rubber Group. Pepco Auditorium, Washington, D. C.

March 20-22

Society of Automotive Engineers. Production Meeting & Forum. Buffalo, N. Y.

March 21-23

Division of High Polymer Physics, APS. Seventeenth Meeting. University of Pennsylvania, Philadelphia, Pa.

April 2

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

April 5

Akron Rubber Group. Spring Meeting. Sheraton Mayflower Hotel, Akron, O.

April 8-10

American Society of Mechanical Engineers. Spring Meeting. Hotel Dinkler-Tutwiler, Birmingham, Ala.

April 11

Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

April 12

Detroit Rubber & Plastics Group, Inc. Spring Meeting.

April 14-27

United States World Trade Fair. Coliseum, New York, N. Y.

April 16-18

American Institute of Chemical Engineers, American Nuclear Society, American Society for Testing Materials, Society for Non-Destructive Testing. Symposium on Nuclear Tests for Non-Destructive Testing Applications. Morrison Hotel, Chicago, Ill.

April 16

Elastomer & Plastics Group, Northeastern Section, ACS. Trip to Owens Corning Fiberglas Plant, Ashton, R. I.

April 17

Washington Rubber Group. Pepco Auditorium, Washington, D. C.

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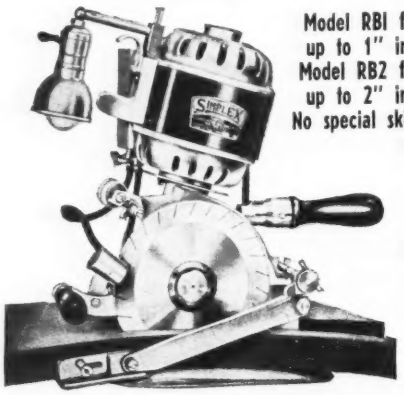

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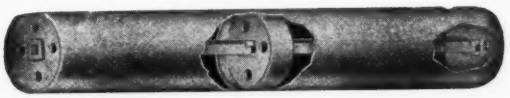

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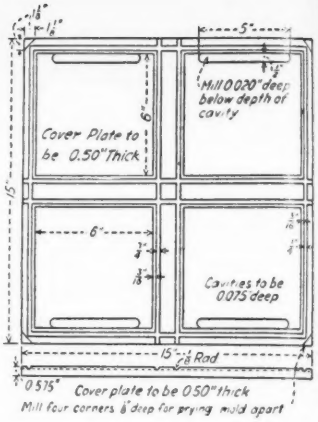

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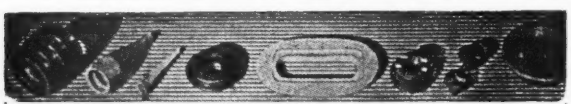

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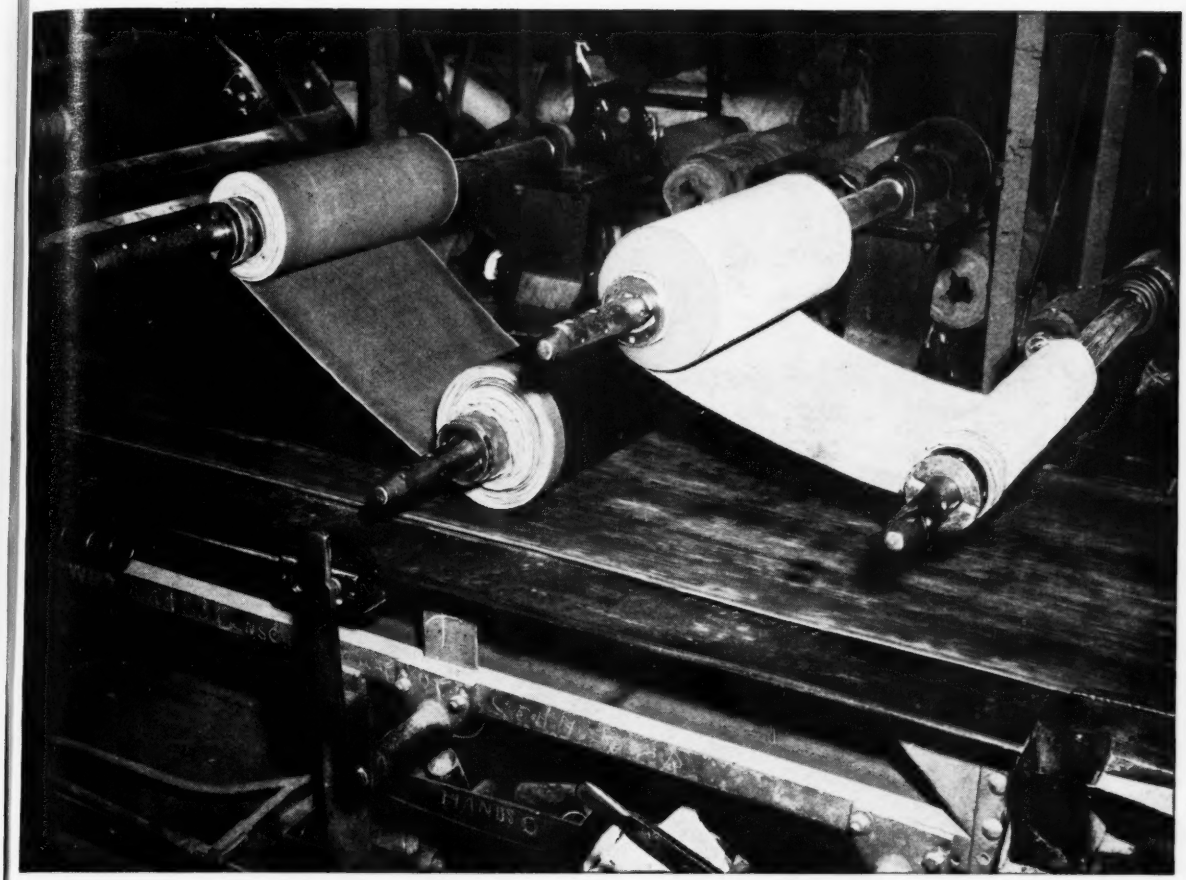

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